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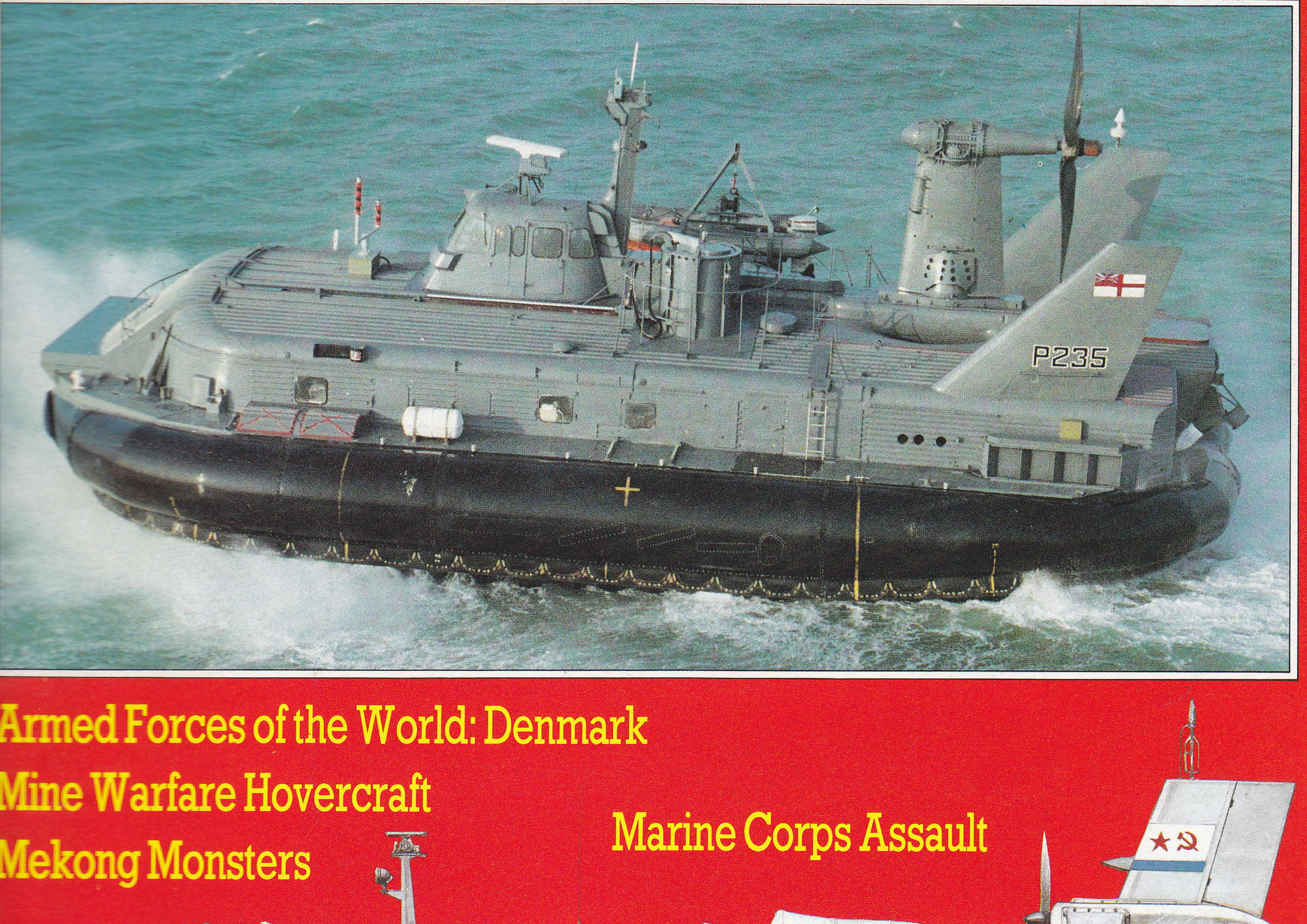

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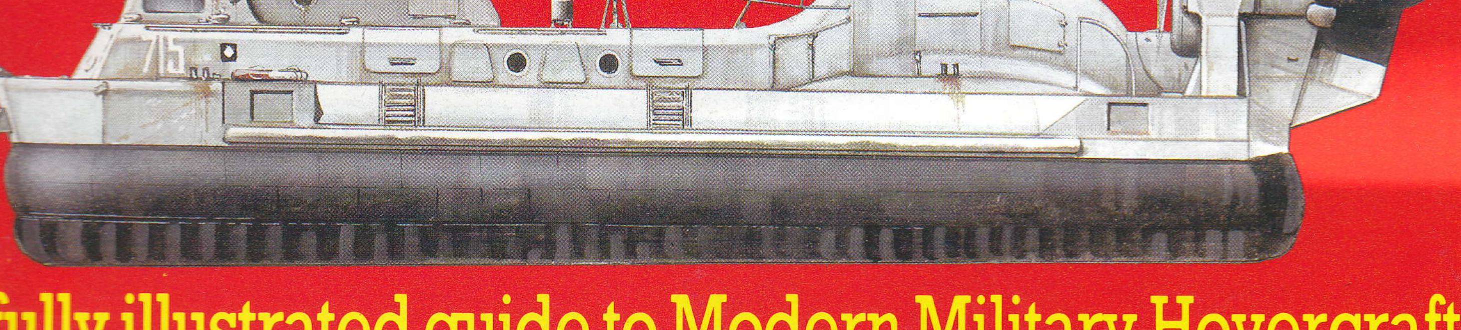

A fully illustrated guide to Modern Military Hovercraft

WAR MACHINE

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Modern Military Hovercraft

The only current hovercraft likely to see action are the SR.N6s and the BH.7 'Wellington' patrol craft of Iran, and the six SR.N6s of Iraq. The BH.7 was also the subject of some of the Royal Navy's Mine Countermeasures trials, during which the air-cushion vehicle proved its suitability for the role.

Modern sea warfare is hovering on the brink of a revolution as great as that sparked off by HMS* Dreadnought *in 1906. A British invention of the 1950s may well give the surface combatant of the year 2000 a performance undreamed of only a decade ago.

Despite the fact that the hovercraft or ACV (Air-Cushion Vehicle) was a British invention more than 25 years ago, the lead in design and use of such craft has long since been lost by the UK to the USSR. With the largest fleet of operational ACVs of five different classes, the Soviet navy has consistently demonstrated the craft's great versatility and viability as an assault vehicle, logistic transport and, it is believed, mine warfare vessel. In addition the USSR is actively exploring the two related areas of the Surface-Effect Ship (SES) and the Wing-In-Ground effect (WIG) aircraft for military applications.

Although the US Navy has realized the military potential of ACV and SES technology, so far it has limited its acquisition of the former to the LCAC landing craft plus a number of earlier trials craft, and of the latter to several SES prototypes and the new MCH 'Cardinal' class for mine countermeasures duties.

In Europe only France has shown a genuine interest in SES warships, whilst the Royal Navy has been forced to abandon hovercraft development (paying off its last ACV in the autumn of 1985) because of the lack of funds and lack of interest on the part of the MoD. Ironically, early in 1986 it was revealed that senior British ship designers and naval officers would be spending a month or so studying the US Navy's SES-200 trials during its eight-month demonstration visit to various European NATO navies.

In the Far East the People's Republic of China is also actively building ACV designs both for military purposes and research. Its Type 722 'Jing-sah' class is similar to a scaled-down British SR.N4 in appearance and is equal in most respects to any Western or Soviet design of similar type.

The Gulf War between Iraq and Iran, which is still being fought, has given ACVs their first extended use in a total-war situation, the only previous operational experience in a combat zone having been during the Vietnam War in the mid-1960s when the US Navy used three licence-built copies of the SR.N5 in the Mekong delta region.

A British Hovercraft AP1-88 demonstrates the air-cushion vehicle's ability to operate over terrain too thick to sail through, and too thin to drive over. It is estimated that 70 per cent of the world's beaches can be landed on by ACVs, as opposed to 17 per cent usable by conventional amphibious forces.

FRANCE

French air-cushion vehicles

The Dubigeon-Normandie **Naviplan N500** was a civilian passenger/car ferry ACV designed for use on cross-channel operations. Like the British SR.N4 hovercraft it could in wartime have been used safely as an emergency logistic transport on routes through suspected enemy minefields that would have stopped conventional ships. Although two craft were originally built, one (the **N500-1**) was written off after a severe fire that started during minor repair work to its skirts. The second (**N500-02 *Ingenieur Jean Bertin***) was subsequently modified to incorporate a bi-conical skirt arrangement that increased the cushion area by some 10 per cent and enabled the bow/stern ramp-equipped craft to lift 418 passengers and 65 vehicles without any increase of installed power. Unfortunately the N500-2 was withdrawn from service in late 1983 because of continuous technical problems which caused high unserviceability. The N500 was characterized in appearance by an aft-mounted horizontal stabilizer that carried the three Avco Lycoming propulsion gas turbines in separate nacelles. Although no longer in use, the design was the largest ACV produced in France and provided much valuable data indirectly to the French navy for any future investment it may make in ACV technology.

Specification

Naviplan N500

Dimensions: length 50.0 m (164.1 ft); beam 23.0 m (75.1 ft)

Propulsion: five 3,200-shp (3877-kW) gas turbines driving two lift fans and three propellers

Weights: maximum 260 tons; payload see text

Speed: 75 kts

Electronics: one navigation radar

FRANCE

French SES types

As part of an overall plan to meet the needs of the French navy for the 1990s and beyond, the Direction Téchnique des Constructions Navales set up a special division to study surface-effect ships for use in the ocean-going ASW role. In 1981 a 5.4-ton 12.1-m (39.7-ft) long seagoing trial craft, called the **MOLENES (Modèl Libre Expérimental de Navire à l'Éffét de Surface)** was launched to study all the systems required by an SES of a higher length-to-beam ratio, to confirm the data produced by water-tank model trials and to investigate the effect of acceleration and manoeuvrability on the structure, equipment and crew members. This is to be followed into service by a 196.43-ton **NES-200** prototype which will confirm the feasibility of such craft in the ASW role and to investigate SES capabilities in other military and commercial roles. The design is being used to obviate the need for the development of any special components such as lift fans or propulsion plant as they can all be bought off-the-shelf for such craft. The information gained from both trials craft will, if satisfactory, be used in the construction of the projected 3,930-ton **NES-4000** SES warship for the next century. The vessel will be fitted with medium-calibre guns, CIWS, surface-to-surface missiles and a large hangar and flight deck aft for a number of ASW helicopters. It will also have a full complement of air, surface and sub-surface sensors.

Specification

NES-4000

Dimensions: length 111.2 m (364.8 ft); beam 30.9 m (101.4 ft); draught on cushion 2.7 m (8.8 ft)

Propulsion: two 40,000-shp (29824-kW) and one 16,750-shp (12489-kW) gas turbines driving two hydrojets and two lift fans respectively; hullborne propulsion uses two diesels delivering 4,800-hp (3579-kW) to two shafts

Weight: maximum displacement 3,930 tons

Speed: on cushion 65 kts, and hullborne 25 kts on gas turbines or 16 kts on diesels.

Armament: two single 76- or 100-mm (3- or 3.94-in) DP guns, one CIWS mounting, and ASW torpedo tubes

Aircraft: four to six ASW helicopters

Electronics: one air-search radar, one surface-search radar, one navigation/helicopter-control radar, one action information system, one ESM suite and two sonar systems (including one towed-array type)

Complement: 130-150

UK

SR.N4 'Mountbatten' class air-cushion vehicle

The **BHC SR.N4 Mk 2 'Mountbatten' class** ACV is a passenger/car ferry suitable for 185-km (115-mile) passages on coastal routes. Although civilian-owned, these craft could have an important wartime logistics role of ferrying reinforcement equipment and supplies across the English Channel without having to worry too much about damaged port facilities or enemy minefields. Only six 'Mountbatten' class craft have been built to date, of which four were converted from the original **SR.N4 Mk 1** to the Mk 2 standard whilst the remaining two went direct to the heavier **SR.N4 Mk 3 Super 4** configuration with a 16.76-m (55-ft) long insert amidships that also increased the beam slightly. The Mk 2s currently carry 282 passengers and 37 vehicles in a single lift, whilst the Mk 3s can carry 418 passengers and 60 vehicles. A military variant, the **Military 4**, was announced in 1980 and this can carry a payload of up to 165 tons of supplies and/or vehicles or a maximum of 1,000 fully-equipped troops at speeds of around 65 kts. It is probable that if stripped of all interior furnishings a bow/stern ramp-equipped civilian SR.N4 could carry similar loads in the logistic transport role, which means for example that all the men of a Royal Marine Commando or an infantry battalion plus most of their equipment could be carried. The only limitation would be the sea state, which if too high would limit the craft's performance.

Specification

SR.N4

Dimensions: length (Mk 2) 39.68 m (130.17 ft) or (Mk 3) 56.38 m (185.0 ft); beam (Mk 2) 23.77 m (78.0 ft) or (Mk 3) 28.04 m (92.0 ft)

Propulsion: four 3,400-shp (2535-kW) gas turbines driving four lift fans and four propellers

Weights: maximum (Mk 2) 200 tons or (Mk 3) 300 tons: payload see text

Speed: (Mk 2) 70 kts (Mk 3) 65 kts

Electronics: two navigation radars

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The British Hovercraft Corporation's SR.N4 is the largest hovercraft in regular service. In an amphibious assault role it can carry up to 1,000 fully-equipped troops, or light tanks. It is similar in size to the Soviet 'Aist' class, which is a purpose-designed amphibious assault craft.

UK

SR.N4 'Mountbatten' class mine countermeasures hovercraft

The **BHC SR.N4 Mk 4 'Mountbatten' class** MCMH (mine countermeasures hovercraft) is identical in most respects to the British Hovercraft Corporation's SR.N4 Mk 2 civilian passenger/car ferry version but with a much larger fuel load. At its maximum weight it is capable of carrying up to 59875 kg (132,000 lb) of mission payload in addition to its fuel for a 10-hour sortie. As designed, it is able to perform all the tasks carried out by a conventional minesweeper with wire and/or influence sweeps, or a minehunter using towed sonar and either a Gemini dinghy with disposal divers or a remote-controlled PAP-104 submersible. The operations room, crew quarters and workshops can be located in the twin side-cabin structures or on the central deck area forward of the main winch position. All the significant fittings in the cargo area are erected on palletized modules in order to facilitate role changes for MCM missions and conversion, if required, to the logistic transport role. A comprehensive communications and navigation fit is carried, as is an MCM-orientated action information system.

On an operation several MCMHs would normally be deployed to form a Forward Support Unit that would set up a Mobile Advanced Base for up to three hovercraft within or very near to a suspected mined area. The craft would then sweep the region as conventional MCM forces would to clear a shipping lane.

If used in the logistic role a single MCMH can carry up to 90 tons of supplies, troops or vehicles in the form of seven loaded trucks and 250 troops, or one MBT, four light tanks and six 1-ton Land Rovers, or four light tanks, two laden and two unladen trucks, and two ambulances.

If the stern is rebuilt, an MCMH can be turned into a fast minelayer carrying some 110-120 ground mines and their trolleys for dropping in all depths of water. To date no military version of the SR.N4 hovercraft has been purchased by any nation.

Specification

SR.N4 Mk 4

Dimensions: length 39.67 m (130.16 ft); beam 23.77 m (78.0 ft)

Propulsion: four 4,250-shp (3169-kW) gas turbines driving four lift fans and four propellers

Weights: maximum 223.4 tons; payload see text

Speed: 60/65 kts

Electronics: one navigation radar, one CAAIS action information system, and one Decca Hi-fix navigation system

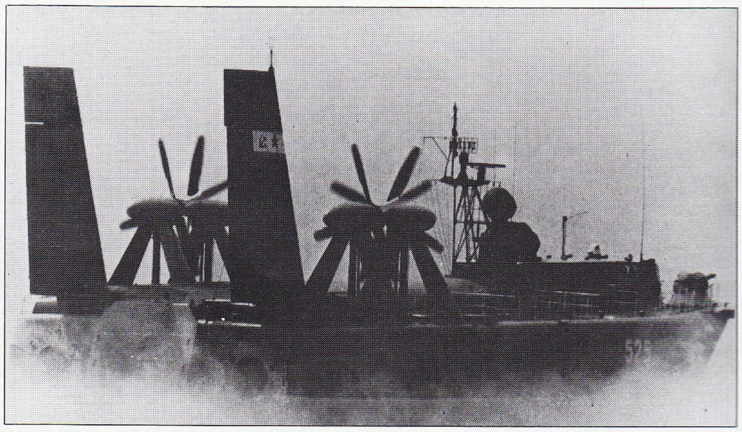
Mine Warfare Hovercraft

With the increase in size of modern hovercraft, which presupposes an increase in carrying capacity, it is natural that naval planners should begin to look at a variety of roles for which the unique qualities of air cushion vehicles may be applicable – particularly in mine warfare.

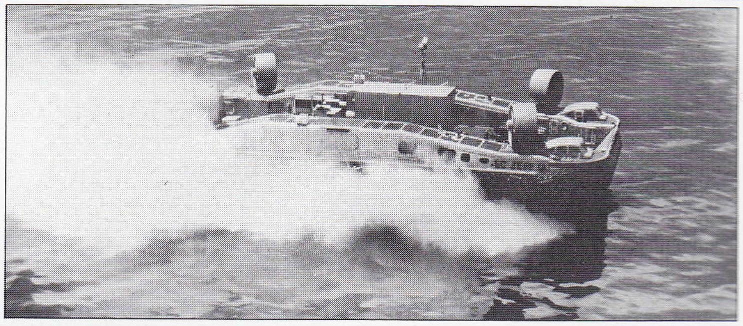
Although the Royal Navy has tested hovercraft extensively in the mine countermeasures role and found them ideal platforms because (amongst other things) they are relatively invulnerable to underwater explosions, the sad fact remains that further development work has been curtailed because of the lack of funds and lack of interest at high levels of the Ministry of Defence. The last Royal Navy hovercraft, a BH7, was returned in the autumn of 1985 to its builders (British Hovercraft Corporation) for disposal.

As usual this contrasts sharply with the position in the UK's closest ally, the USA, whose navy placed an order with Bell Halter Incorporated for the USS *Cardinal* (MSH-1), the prototype of a class of glass reinforced plastic minesweeper/minehunters with an SES (Surface-Effect Ship) type hull. Like a hovercraft the SES rides on a 'bubble' of air but, instead of being contained by a flexible all-round skirt, the air is contained by rigid sidewalls (that penetrate the water's surface to improve stability in rough seas) and flexible skirts fore and aft. This means that an MCM SES craft is more resistant to underwater shocks from a mine explosion than a conventional-hulled MCM craft as the cushion's lift keeps most of the hull clear of the water surface. (The hovercraft is more resistant still as its hull is usually 1 m/3.3 ft or more above the water, riding on a cushion of air that can absorb a large part of the shock wave.) The air cushion also reduces the SES's underwater magnetic, acoustic and pressure signatures, thereby considerably reducing the chances of detonating a mine before it can be detected by the sensors aboard. The sonar system fitted is initially to be of the hull-mounted SQQ-30 variable-depth mine-detection and classification type (an upgraded SQQ-14) but because of its limitations this is to be replaced as soon as possible by the brand new SQQ-32 set. The craft will also carry the SSN-2 Precise Integrated Navigation Systems (PINS) with a command and control suite for displaying data on mine locations and exchanging information with other MCM units.

In the conventional minesweeping role the *Cardinal* will carry and use a Size 1 mechanical sweep, a Mk 5 magnetic sweep and single Mk 4V and Mk 6G acoustic sweeps; for minehunting the *Cardinal* will be able to deploy a single cable-controlled Mine Neutralization Vehicle (MNV) to examine and destroy



Given the intense Soviet interest in surface skimmers of all kinds, together with a realistic appreciation of the potentials of mine warfare, it would seem natural for the USSR to have attempted to combine the two. One of the most suitable craft for such use would be the 270-ton 'Aist' class vessel.



Above: The US Navy's LCAC amphibious hovercraft programme saw two main designs produced, with the contract going to Bell's AALC. JEFF(A), the losing design from Aerojet, has been retained for research into mine countermeasures, Arctic operations and large-scale medical evacuation.

Below: Originally acquired by the Royal Navy for trials in the logistic support role, the Vosper Thornycroft VT-2 was extensively modified for mine countermeasure support. It proved much less vulnerable to underwater explosions than did conventional displacement vessels.

VT2
ROYAL NAVY

mines. The 3.8-m (12.5-ft) long MNV will be on the end of a 1525-m (5,000-ft) cable, weigh about 998 kg (2,200 lb), be capable of 6 kts under water, and be fitted with a closed-circuit TV camera in the nose and with facilities for severing the cables of moored mines or for planting an explosive charge near a ground mine.

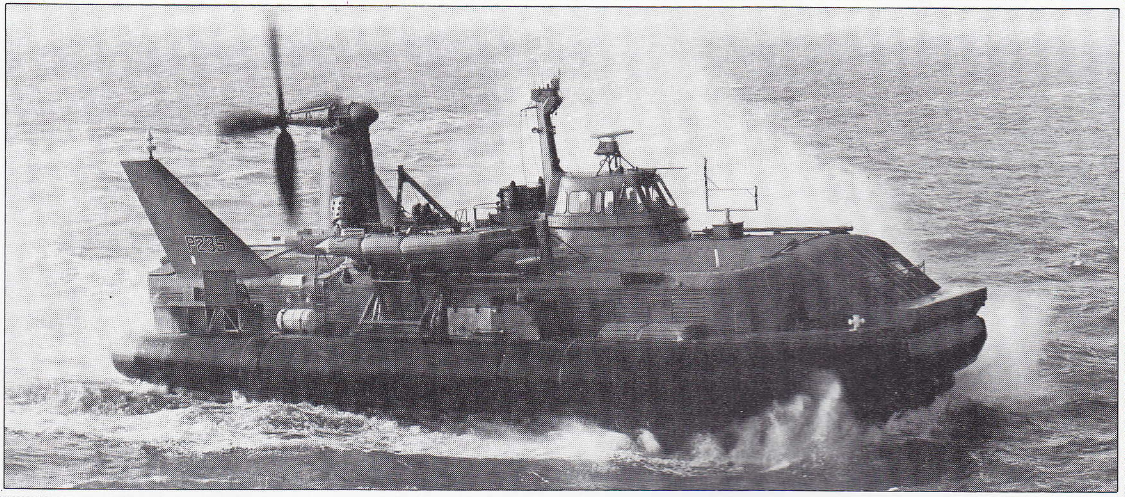
Some 17 MSH craft are to be built so that three can be based at Newport, Rhode Island and Groton, Connecticut, five at Norfolk, Virginia, six at Charleston, South Carolina, and three at Mayport, Florida with the primary mission of protecting US strategic missile submarine bases, the approaches to the bases and the SSBNs' transit routes to deep water.

In the UK BHC has capitalized on the experience gained by the Royal Navy and has designed mine countermeasures variants of its SR.N4 (the SR.N4 Mk 4 MCMH) and BH7 (the BH7 Mk 20 MCMH). During the various navy trials of hovercraft types it was proved that a hovercraft, when compared with a conventional minesweeper, has a much faster transit speed (up to five times greater) to the operating area, a much better track-keeping ability in rough weather, and the already-mentioned lower underwater signatures.

During the initial search for mines at speeds between 12 and 20 kts, towed side-scan, variable-depth or hull-mounted retractable sonars can be employed, the subsequent sweeping being performed by all the conventional towed gear found aboard RN minesweepers or, as in the case of the BH7, by the American towed Mk 103 mechanical, Mk 104 acoustic, Mk 105 magnetic or Mk 106 combined acoustic/magnetic sled sweeps normally used by US Navy minesweeping helicopters. The Mk 103 is towed at speeds up to 12 kts, the Mk 104 at up to 30 kts, and the other two at up to 28 kts.

For minehunting the MCMH configurations can be changed and the search speed reduced to between 2 and 5 kts for the sonar hunting phase. Once a contact has been made the sonar is switched to its classification mode, and if the target is confirmed as a mine a remotely-controlled wire-guided PAP-104 mine-disposal vehicle is sent down to confirm by TV camera and lay an HE charge as near to it as possible. The PAP-104 is then recovered and the charge detonated to destroy the mine. If a mine-disposal vehicle is not used, a Gemini dinghy is launched with divers aboard to do the work by hand.

As in the American 'Cardinal' class and contemporary British MCMVs, a precise navigation system and a command and control centre are fitted. The bonus of the MCMHs is that because of their modularized/palletized payloads they can be stripped of mine warfare equipment to serve as logistic supply craft in time of need. In the light of the hovercraft's success in the MCM field it is surprising that the Royal Navy went for a conventional mix of new-generation surface vessels instead of a more radical hovercraft/surface ship package, especially as the cost of a 'Brecon' class MCMV is now approaching that of a fully equipped MCMH.



Left: Also involved in the Royal Navy MCMH trials, the British Hovercraft BH.7 Mk 2 demonstrated the low magnetic and acoustic signatures, together with much greater speed than conventional minesweepers. The major problem was of course expense, as ACVs cost a lot to run.

Below: The US Navy has ordered the first of a new generation of harbour minesweepers from Bell-Textron. They will be Surface Effect Ships – rigid-walled hovercraft – which combine many of the advantages of the ACV and the catamaran. This is the SES-200, which is testing the SES concept.

UK

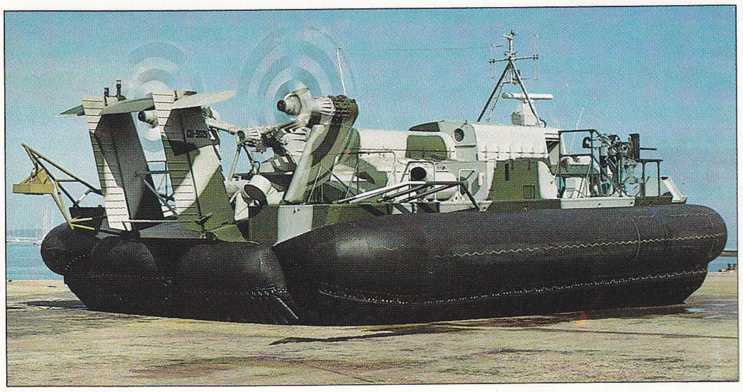
SR.N6 'Winchester' class air-cushion vehicle

Designed originally as a fast ferry for operations in sheltered waters, the **BHC SR.N6 'Winchester' class** ACV has evolved into a number of variants over the years. Although extensively tested by the Royal Navy and British army all over the world, including the Falklands, the SR.N6 craft used were sold in 1982 following the demise of the Hovercraft Trials Unit. The basic **SR.N6 Mk 1** can accommodate either 38 passengers or 3 tons of supplies, and is in use with the Egyptian navy (one) and the Royal Saudi Arabian Frontier Force and Coast Guard (eight). This model was followed by the wholly military logistic support **SR.N6 Mk 2** and **SR.N6 Mk 3** variants, which feature a roof loading hatch and specially strengthened side decks for long loads weighing up to 0.5 ton; a roof-mounted armament of one 7.62- or 12.7-mm (0.3- or 0.5-in) machine-gun is carried for defensive purposes. The maximum payload is increased to 5 tons of supplies or between 20 and 30 fully armed troops. Only the Egyptian (two Mk 2s) and Iranian (two Mk 2s) navies have this type in service, though the former has had all three of its SR.N6s modified to carry six 500-kg (1,105-lb) ground mines if required. The Iranian navy also has six **SR.N6 Mk 4** variants in service. These are used for coastal defence duties and can carry either a 20-mm cannon or SS.12 wire-guided missiles as alternatives to the more usual 7.62-mm medium machine-guns. The Iraqi customs service also uses the same hovercraft, but as the **SR.N6 Mk 6C** general-purpose model, with a larger cabin to accommodate up to 55 passengers or between 5 and 6 tons of supplies. Six are in use, and are known to have been used for combat duties in the Gulf War.

Saudi Arabia also has eight units of the **SR.N6 Mk 8** type in service. This is the latest of the military variants to be produced: it can carry up to 55 fully-equipped troops in the assault role, or have the same armament alternatives as the Mk 4 when used as a patrol craft. It differs from the earlier variants in having only a single propeller and the addition of two air conditioning units on the roof aft of the cockpit.

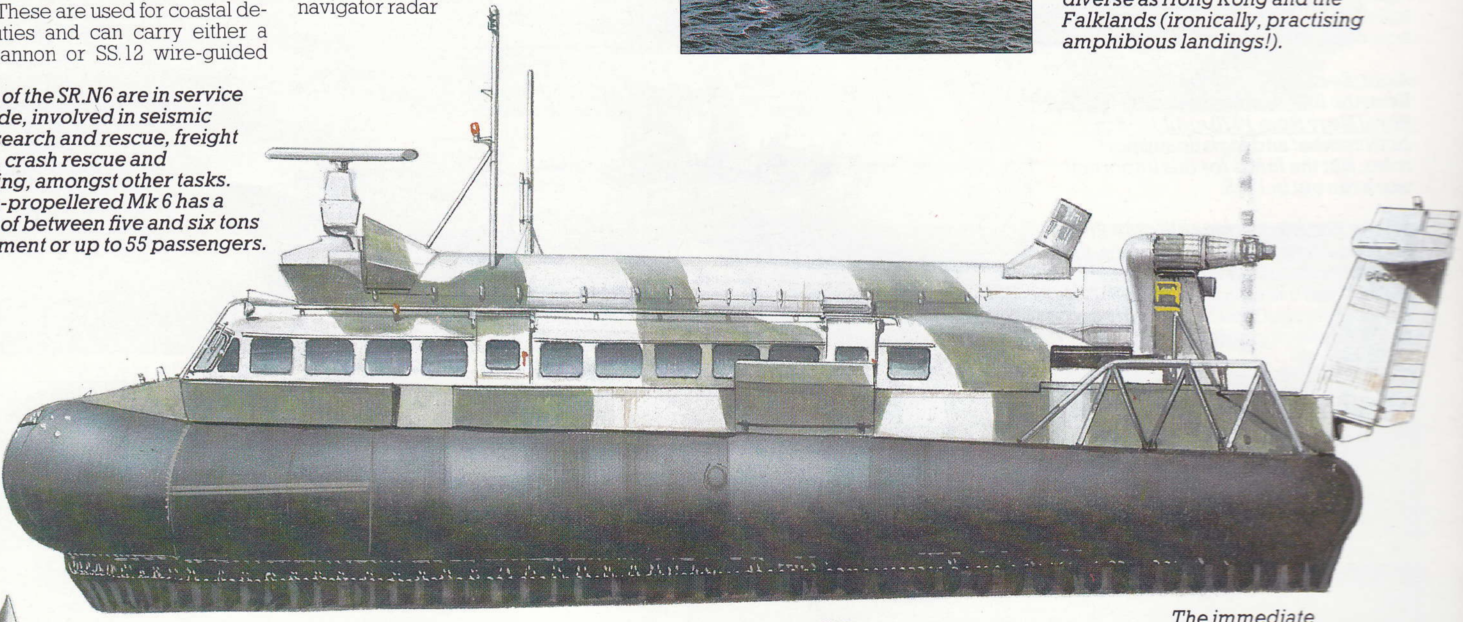
Specification

SR.N6 Mk 8
Dimensions: length 18.3 m (60.0 ft); beam 8.5 m (28.0 ft)
Propulsion: one 1,050-shp (785-kW) gas turbine driving one lift fan and one propeller
Weights: maximum 16.7 tons; payload see text
Speed: 50 kts
Electronics: one navigator radar

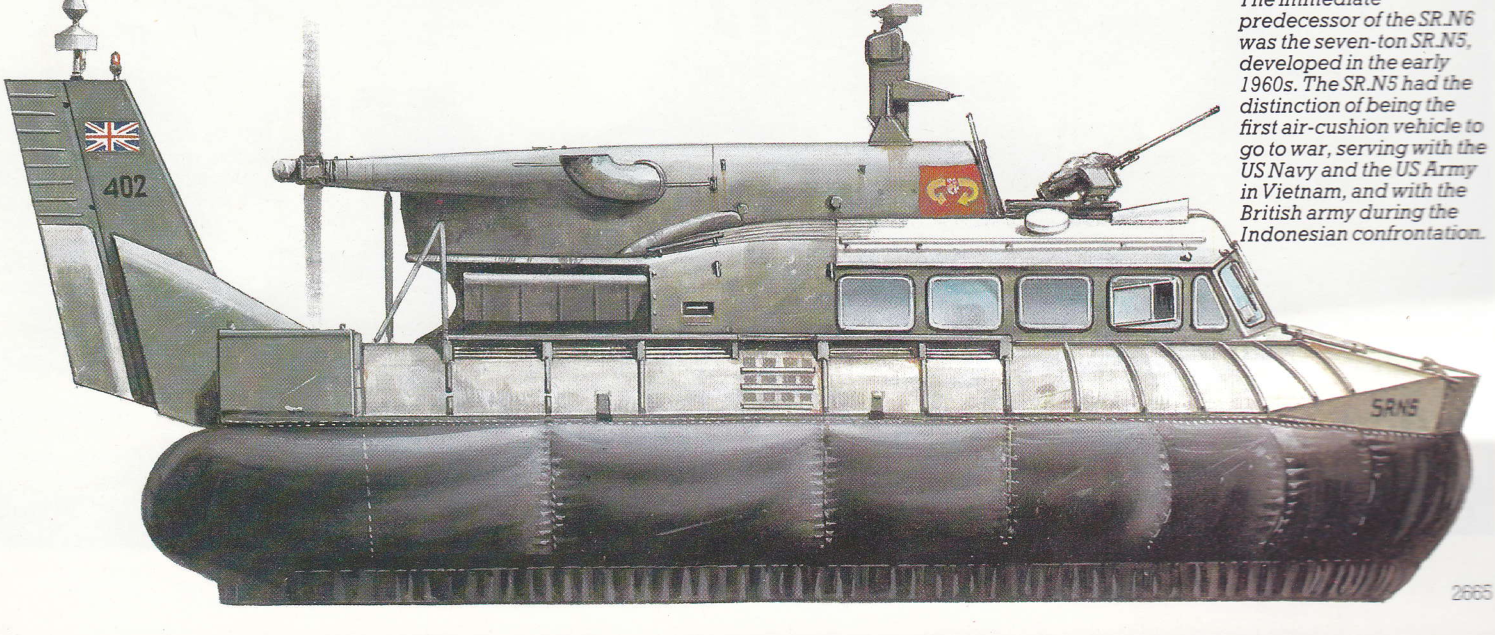


Above: SR.N6 'Winchester' is the military variant of the widely-used SR.N6 fast ferry. It can be used in the logistics role over swampy terrain or, as here, as a fast coastal patrol craft. It can be armed with 20-mm cannon or with short-range SSMs.

Left: The SR.N6 Mk 2/3 is a militarized version of the standard civil ferry, and unlike the later Mk 6 seen above is powered by a single propeller. This model was operated by the Royal Navy trials unit in locations as diverse as Hong Kong and the Falklands (ironically, practising amphibious landings!).



Variants of the SR.N6 are in service worldwide, involved in seismic survey, search and rescue, freight haulage, crash rescue and firefighting, amongst other tasks. The twin-propellered Mk 6 has a payload of between five and six tons of equipment or up to 55 passengers.



The immediate predecessor of the SR.N6 was the seven-ton SR.N5, developed in the early 1960s. The SR.N5 had the distinction of being the first air-cushion vehicle to go to war, serving with the US Navy and the US Army in Vietnam, and with the British army during the Indonesian confrontation.

UK

BH7 'Wellington' class air-cushion vehicle

The **BHC BH7 'Wellington' class** was designed specifically for navy and military use, the **BH7 Mk 2** prototype serving with the Royal Navy (from 1970 to late 1985, when funds ran out) as an advanced-technology trials craft to evaluate hovercraft in the logistic support, fishery protection, ASW and MCM roles. This machine was followed on the production line by two **BH7 Mk 4** logistic support and four **BH7 Mk 5** combat versions for the Iranian navy. The former, armed with medium machine-guns on each side of the cabin, can carry loads such as 170 fully-armed troops, or 60 troops with three Land Rovers and trailers, or two light armoured vehicles, or up to 14 tons of supplies. The Mk 5s were designed for coastal defence duties, and have recesses on their side decks for two medium-range anti-ship SSMs (such as the MM.38 Exocet) plus the ability to carry a radar-controlled twin 30-mm turret on the foredeck in front of the centre cabin, which is used as the operations centre. Although not armed as such in Iranian service, the Mk 5s and the logistic Mk 4s have seen considerable combat service during the Gulf War.

In 1982 the Saudi Arabian navy ordered eight **BH7 Mk 5A** combat/logistic hovercraft, which are essentially similar to the Mk 5 but retain the bow door of the logistic model in order to keep the load-carrying capability. However, instead of the 30-mm turret two single 20-mm cannon can be mounted on the roof positions previously used for machine-guns.

A follow-on version is the **BH7 Mk 20** multi-role craft, which is a stretched model with greater payload and the latest advances in skirt technology. To date no country has bought this variant.

Specification

BH7 Mk 5A

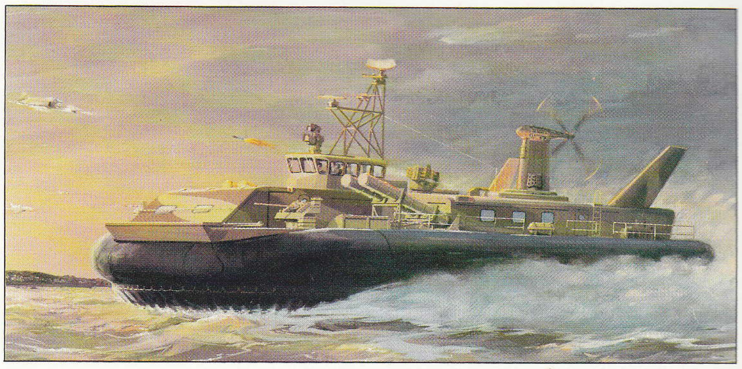
Dimensions: length 23.9 m (78.33 ft); beam 13.9 m (45.5 ft)

Propulsion: one 4,250-shp (3169-kW) gas turbine driving one lift fan and one propeller

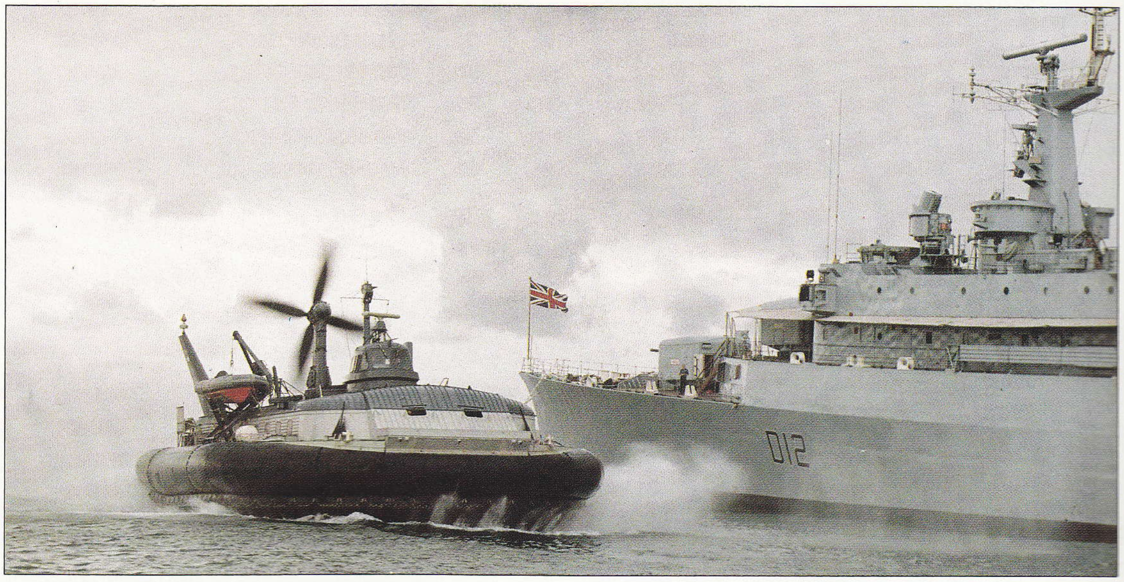
Weights: maximum 55 tons; payload see text

Speed: 58 kts

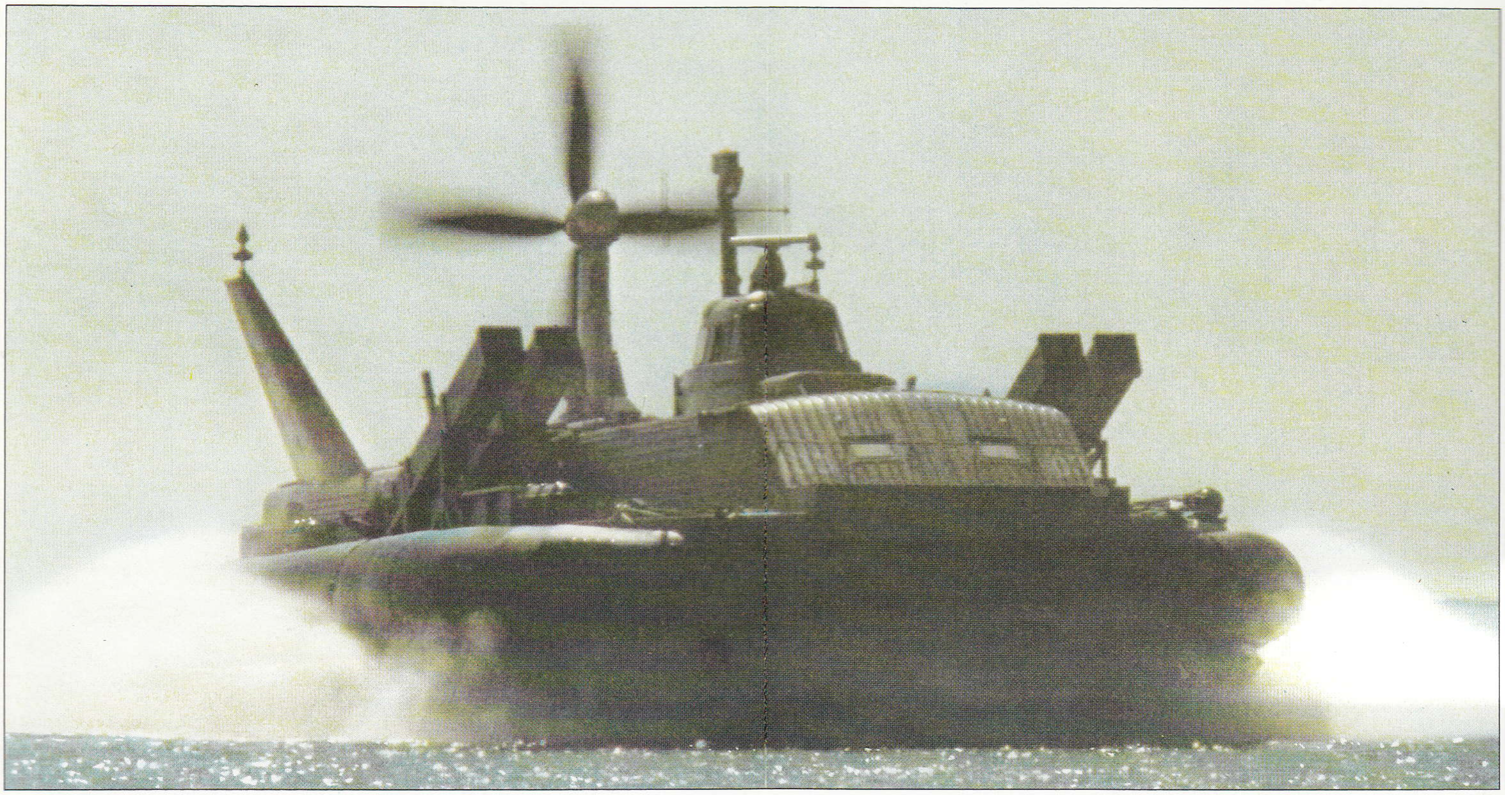
Electronics: one navigation radar



Above: The latest variant of the BH7 'Wellington' is the Mk 20 Fast Attack Craft, which can carry an impressive weapon fit, in this case a pair of Rarden 30-mm cannon and four Sea Skua surface-to-surface missiles. Sea Cat SAMs or Exocet SSMs are alternative armaments.



Right: Seen here speeding past HMS Kent, *the BH7 was evaluated by the Royal Navy from 1970 until 1985 in both combat and logistic support roles, but the funds for this important work ran out in 1985.*



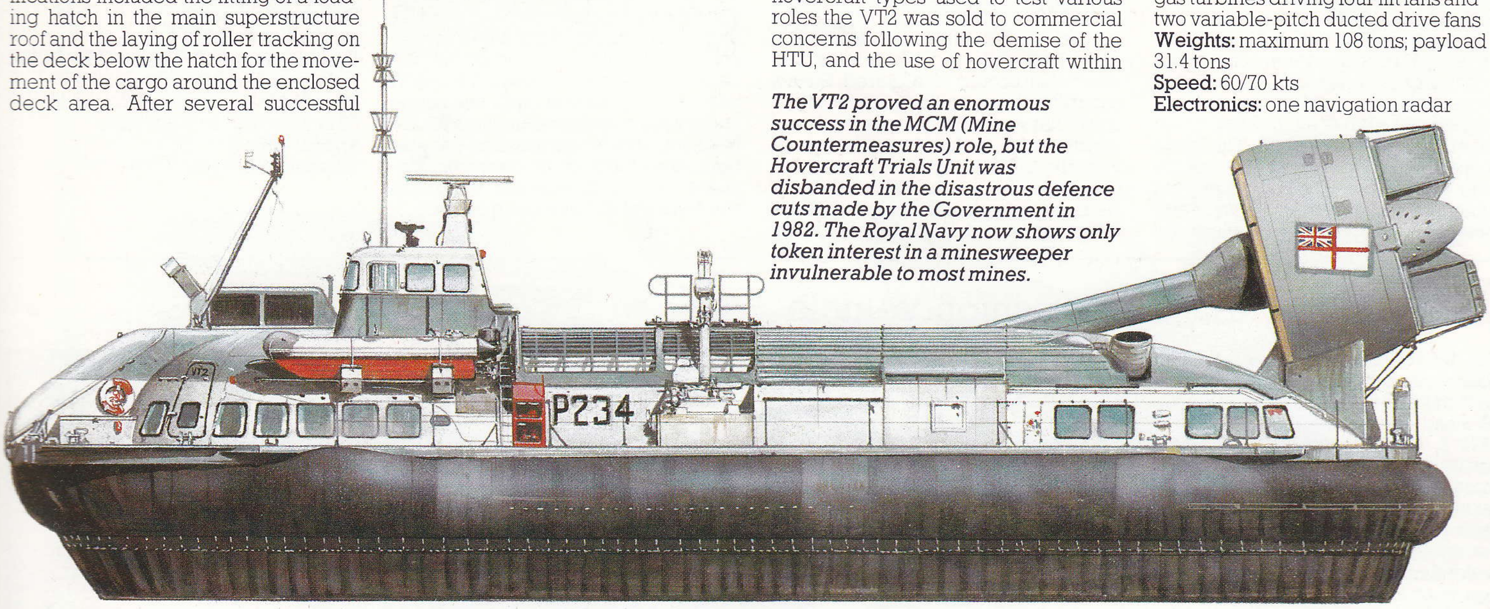
Below: The Mk 5 is capable of 58 kts and can carry four Exocet surface-to-surface missiles. The Iranians have made great use of their logistic support version, which can carry up to 170 fully-equipped troops.

UK

VT2 air-cushion vehicle

The **Vosper Thornycroft VT2** hovercraft was extensively tested by the Royal Navy from the mid-1970s until 1982, when the Hovercraft Trials Unit (HTU) was disbanded as part of extensive defence cuts. Used originally in the logistic support role, the prototype **VT2-001** (P234) was modified in 1978 to carry palletized cargo from ships lying offshore to a beach-head. The modifications included the fitting of a loading hatch in the main superstructure roof and the laying of roller tracking on the deck below the hatch for the movement of the cargo around the enclosed deck area. After several successful trials, the prototype was further rebuilt to investigate its operational capabilities in the MCM support role. This required the fitting of an electronic and communications outfit compatible in all respects to that of the contemporary 'Hunt' class MCM vessel, an Atlas 5002 hydraulic crane, a larger roof hatch and improved internal cargo-handling system and a 5.4-m (17.7-ft) long Sea Rider workboat. Again the craft proved highly successful, especially in the towing of various types of sweeping gear and in shock trials, in which it proved almost invulnerable to underwater explosions near or practically beneath the hull to simulate the detonation of various seamine types. Despite this and the success of the other hovercraft types used to test various roles the VT2 was sold to commercial concerns following the demise of the HTU, and the use of hovercraft within the Royal Navy and other armed services has been reduced to the barest minimum so that the forces can say that interest is still being shown.

Specification
VT2
Dimensions: length 30.18 m (99.0 ft); beam 13.3 m (43.6 ft)
Propulsion: two 4,250-shp (3169-kW) gas turbines driving four lift fans and two variable-pitch ducted drive fans
Weights: maximum 108 tons; payload 31.4 tons
Speed: 60/70 kts
Electronics: one navigation radar



The VT2 proved an enormous success in the MCM (Mine Countermeasures) role, but the Hovercraft Trials Unit was disbanded in the disastrous defence cuts made by the Government in 1982. The Royal Navy now shows only token interest in a minesweeper invulnerable to most mines.

UK

Skima series air-cushion vehicles

The Skima series of ACVs incorporates inflatable structures into its basic design, and this helps to reduce the overall weight and total cost. It also enhances the series' obstacle clearance, buoyancy and stability characteristics. The smallest of the craft offered for military use is the open-top **Skima 4**, which has been evaluated by the Royal Navy, US Navy and the US Coast Guard. Able to carry four persons, it can be transported on a light trailer or folded inside a pick-up truck and lifted off by the crew. Next in size is the **Skima 6** which has also been evaluated by the Royal Navy and bought by the Australian army and several police forces for patrol duties. It is car-sized in appearance and can be moved either on a large trailer or towed behind a light trailer as a single unit. An enclosed cabin is provided for the pilot and five passengers. The largest craft available is the **Skima 12**, which differs from the civilian version in having its controls moved amidships, in front of a mast arrangement carrying a small navigation/surface-search radar. With the controls aft the ACV can then carry a variety of weapons mounted in the space thus vacated. The Skima 12 can carry up to 12 people or around 998 kg (2,200 lb) of supplies. The Nigerian police are known to have bought several for river patrol work.

Specification
Skima 4
Dimensions: length 4.80 m (15.75 ft); beam 1.98 m (6.5 ft)
Propulsion: one 25-hp (18.6-kW) petrol or diesel engine driving a single lift and propulsion propeller
Weights: empty 225 kg (495 lb); payload see text
Speed: 30 kts

Specification
Skima 6
Dimensions: length 6.19 m (20.31 ft); bean 2.62 m (8.6 ft)
Propulsion: one 60-hp (44.7-kW) petrol or diesel engine driving a single lift and two propulsion propellers
Weights: empty 670 kg (1,474 lb); payload see text
Speed: 30 kts

Specification
Skima 12
Dimensions: length 7.77 m (25.5 ft); beam 3.5 m (11.5 ft)
Propulsion: one 250-hp (186-kW) petrol or diesel engine driving a single lift and propulsion propeller
Weights: empty 990 kg (2,178 lb); payload see text
Speed: 35 kts
Electronics: one navigation radar

The Skima series of small air-cushion vehicles are based on the original Griffon designs now being manufactured by Vosper Hovermarine. The smallest of these craft can be transported on the back of a pick-up truck, and has been evaluated both in the UK and USA.

The various Skima ACVs keep down their weight and reduce overall cost by incorporating inflatable structures into the basic design. This also gives improved buoyancy and stability, and endows them with impressive obstacle-crossing ability.

USSR

Ekranoplan wing-in-ground effect machines

Since 1965 the Soviets have been experimenting in the Caspian Sea area with what has become known as the **Ekranoplan** or 'Caspian Sea Monster'. This machine has a potential speed of 300 kts (556 km/h; 346 mph) or more, and operates at a height of between 3.5 to 14 m (11.5 to 46 ft) above water, marshland or other such terrain. With a main hull like that of a wide-body airliner, the Ekranoplan can carry a payload of over 90 tons, or some 900 fully-equipped troops or Naval Infantry. Its propulsion system comprises eight marinized gas turbines mounted above a forward stub wing and two propulsion turbines aft installed at the base of a dihedral tailplane. The mode of operation is that all the engines are used to start the Ekranoplan moving whilst the machine is in contact with the water; the forward engines are then directed downwards so that their exhausts create an air-cushion effect under the vehicle's main wing. The growing lift then raises the vehicle clear of the water so that the forward engines can be reorientated to direct their blast back over the upper surface of the wing to establish additional lift and so rapidly increase the forward motion until the cruising speed at which flight can be sustained is established. By flying in and out of this ground-effect cushion the Ekranoplan can clear shipping, shorelines and other obstructions as required. Such a capability is particularly useful to the Soviet navy for amphibious assault and logistic support duties as this type of vehicle effectively overcomes the problems of sea conditions, tidal currents, underwater obstacles, and defensive sea and land minefields by flying over them.

A smaller **Turboprop Ekranoplan** is also under test. Based on the 'sea monster' concept, this has improved aerodynamic shape and the rear-mounted gas turbines replaced by a single 15,000-shp (11184-kW) turboprop. The forward engines are also replaced by two internally-mounted gas turbines to provide the power augmentation for take-off and the initial lift. The new variant has also been used for amphibious assault trials with a swing-nose arrangement to allow for the carriage of vehicles and outsized loads. A missile attack variant (with two single underwing container-launchers for SS-N-22 anti-ship cruise missiles) has also been seen, although no production decision on any Ekranoplan version is believed yet to have been taken.

Specification (provisional)
Ekranoplan
Dimensions: span 40.0 m (131.23 ft); length 91.4 m (300.0 ft)
Propulsion: 10 gas turbines
Weights: maximum 307.4 tons; payload see text
Speed: 300 kts

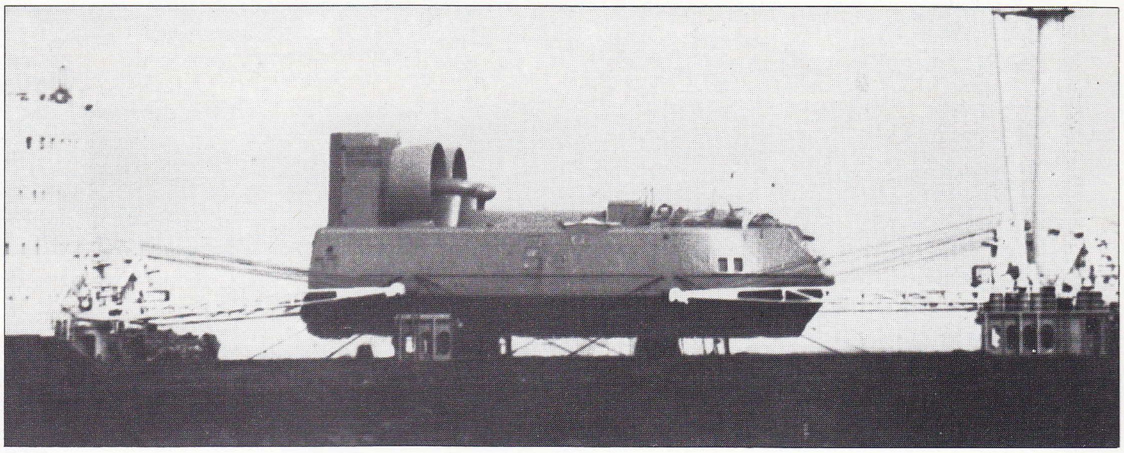
Specification
Turboprop Ekranoplan
Dimensions: span 30.5 m (100.0 ft); length 60.9 m (200.0 ft)
Propulsion: one 15,000-shp (11184-kW) turboprop and two gas turbines
Weights: maximum 216 tons; payload 59 tons of cargo or 500 troops
Speed: 280 kts
Armament: see text

USSR

'Lebed' class air-cushion vehicle

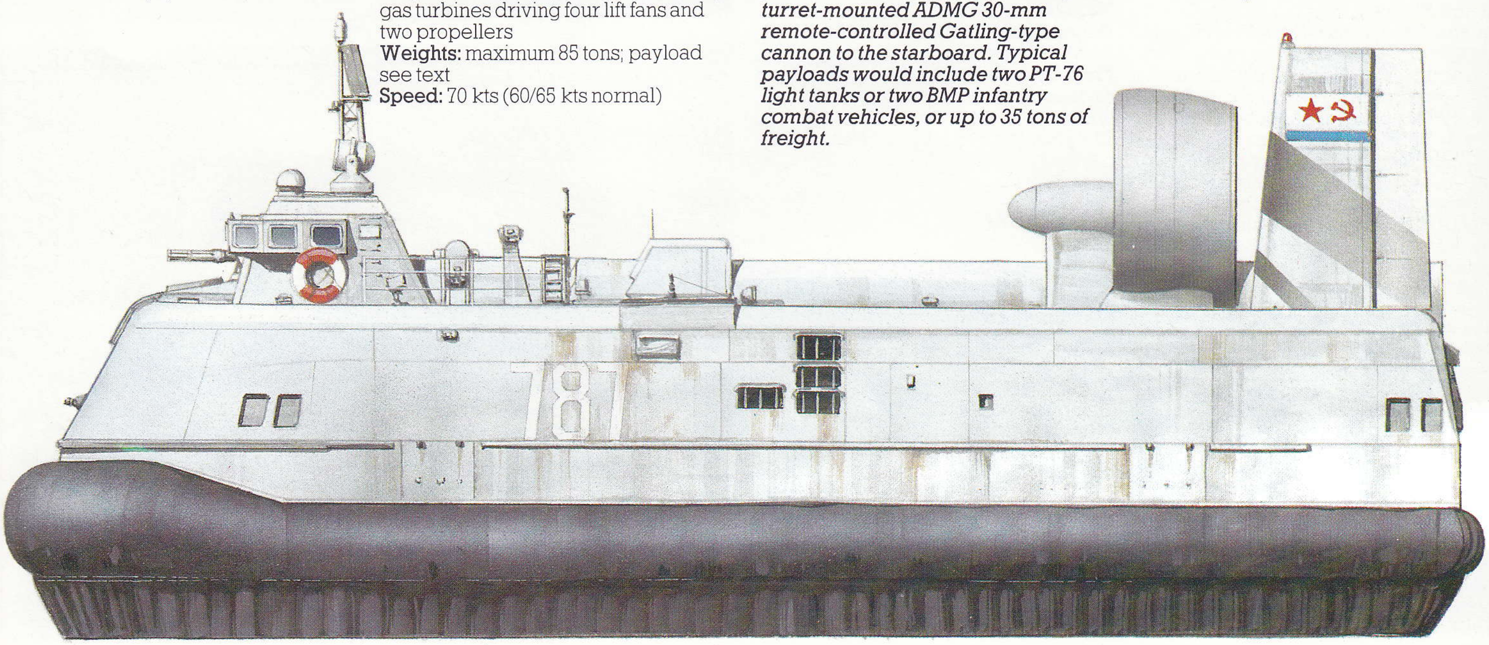
The NATO reporting named **'Lebed' class** multi-duty surface-effect landing craft was first seen in prototype form in 1973 and entered series production in 1976-7. Used as amphibious initial assault landing and logistics-over-the-shore (LOTS), 'Lebeds' are normally carried in pairs by the 'Ivan Rogov' class LPDs in their stern well decks. For an assault the 'Lebeds' would be preloaded before embarking. The design is an original Soviet one, and is thought to have been undertaken by the Soviet navy's High-Speed Ship Design Bureau in Leningrad. Eighteen 'Lebeds' are in service, with some three or four more in varying states of completion. 'Lebeds' are now found with the Baltic, Black Sea and Pacific Fleets as well as aboard the LPDs. A bow ramp is provided for vehicle loading and unloading, whilst personnel can use doors located aft. Typical payloads include two PT-76 light amphibious tanks, two BTR-60/70/BMP-1/2 APCs, two loaded trucks up to a total weight of 34.38 tons, 120 Naval Infantry or some 40 tons of supplies.

In 1982 the prototype of what is expected to be the 'Lebed' successor, the 100-ton 'Tsaplya' class, was seen. This is now believed to be entering series production on the construction line that was used for the 'Lebed' class.



Mounted on the deck of a Soviet transport vessel, the 'Lebed' class of amphibious assault hovercraft is somewhat smaller than the American LCAC or the British Vosper VT2. The class has been designed to operate out of the docking wells of 'Ivan Rogov' class amphibious assault ships.

Specification
'Lebed' class
Dimensions: length 24.8 m (81.4 ft); beam 10.8 m (35.4 ft)
Propulsion: three 3,600-shp (2684-kW) gas turbines driving four lift fans and two propellers
Weights: maximum 85 tons; payload see text
Speed: 70 kts (60/65 kts normal)
Armament: one ADMG6-30 six-barrel CIWS mounting on forward quarter of the starboard superstructure
Electronics: one navigation radar, and one 'High Pole-B' IFF system



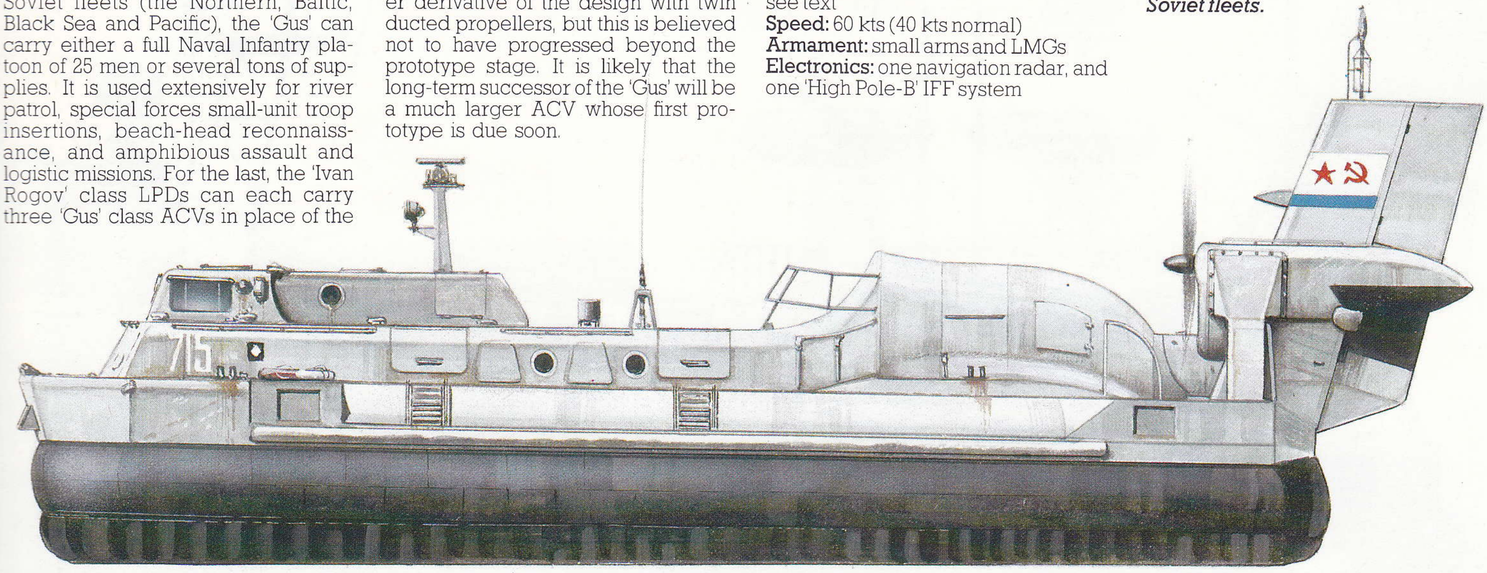
The cockpit of the 'Lebed' is on the port side of the craft, balanced by a turret-mounted ADMG 30-mm remote-controlled Gatling-type cannon to the starboard. Typical payloads would include two PT-76 light tanks or two BMP infantry combat vehicles, or up to 35 tons of freight.

USSR

'Gus' class air-cushion vehicle

Developed from the 50-seater 'Skate' class amphibious passenger ferry ACV, the **'Gus' class** logistic support ACV was tested in prototype form from 1969 onwards, series production of 36 craft taking place between 1970 and 1982 at a steady rate of two or three units per year. Deployed by all four Soviet fleets (the Northern, Baltic, Black Sea and Pacific), the 'Gus' can carry either a full Naval Infantry platoon of 25 men or several tons of supplies. It is used extensively for river patrol, special forces small-unit troop insertions, beach-head reconnaissance, and amphibious assault and logistic missions. For the last, the 'Ivan Rogov' class LPDs can each carry three 'Gus' class ACVs in place of the two 'Lebed' class ACVs and one 'Ondatra' class LCM usually embarked. Some six or so of the 36 units were completed with two pilot positions and have been issued to the 'Gus' class ACV battalions of the fleets as operational conversion trainers. There has also been at least one further derivative of the design with twin ducted propellers, but this is believed not to have progressed beyond the prototype stage. It is likely that the long-term successor of the 'Gus' will be a much larger ACV whose first prototype is due soon.

Specification
'Gus' class
Dimensions: length 21.33 m (70.0 ft); beam 7.1 m (23.3 ft)
Propulsion: three 780-shp (582-kW) gas turbines driving one lift fan and two propellers
Weights: maximum 26.7 tons; payload see text
Speed: 60 kts (40 kts normal)
Armament: small arms and LMGs
Electronics: one navigation radar, and one 'High Pole-B' IFF system



The 'Gus' class logistic support ACV is roughly equivalent to the British SR.N6, although used by the Soviets in combat roles much more than those in the west. Used extensively by Soviet naval infantry on river patrol, small-unit insertions and assaults, the class serves with all Soviet fleets.

USSR

New Soviet air-cushion vehicles

In the early 1980s two new Soviet naval ACV prototypes were sighted by NATO reconnaissance units. The first, named the **'Tsaplya' class** by NATO, is thought to be the successor to the 'Lebed' class which is about to end its production run. It is similar in size, configuration and performance to the British BH7 Mk 4 and incorporates a bow door and central load well. Designed for use aboard the 'Ivan Rogov' class LPDs and their successors, the craft can carry one PT-76 light amphibious tank and 80 Naval Infantry, 160 Naval Infantry, or some 25 tons of cargo. The second design, named the **'Utenok' class**, is slightly longer but smaller overall, and appears to be designed to carry one T-54/55/62/72/74 MBT as its primary payload. With two 'Utenoks' currently undergoing extensive testing along wiht the single 'Tsaplya', it is possible that both designs are actually complementary to one another with the aim that the 'Ivan Rogov' class LPDs will eventually have the ability to deliver MBTs beyond the water line of a beach-head rather than relying on the more conventional 'Ondatra' class LCM carried at present. If this assumption is correct, it is probable that the LPDs will be carrying mixed loads of 'Lebeds' and 'Utenoks', or 'Lebeds' or 'Tsaplya', or 'Tsaplya' and 'Utenoks' by the end of the 1980s, the actual mix depending upon the operation to be mounted.

Specification (provisional)
'Tsaplya' class
Dimensions: length 24.0 m (78.75 ft; beam 14.0 m (45.9 ft)
Propulsion: not known
Weights: maximum 100 tons; payload see text
Speed: 65 kts
Armament: two 30-mm twin turrets
Electronics: one 'Spin Trough' navigation radar, and one 'High Pole-B' IFF system

Specification (provisional)
'Utenok' class
Dimensions: length 26.3 m (86.3 ft); beam 13.0 m (42.7 ft)
Propulsion: not known
Weights: maximum 80 tons; payload see text
Speed: 65 kts
Armament: two 30-mm twin turrets
Electronics: one 'Spin Trough' navigation radar, and one 'High Pole-B' IFF system

USSR

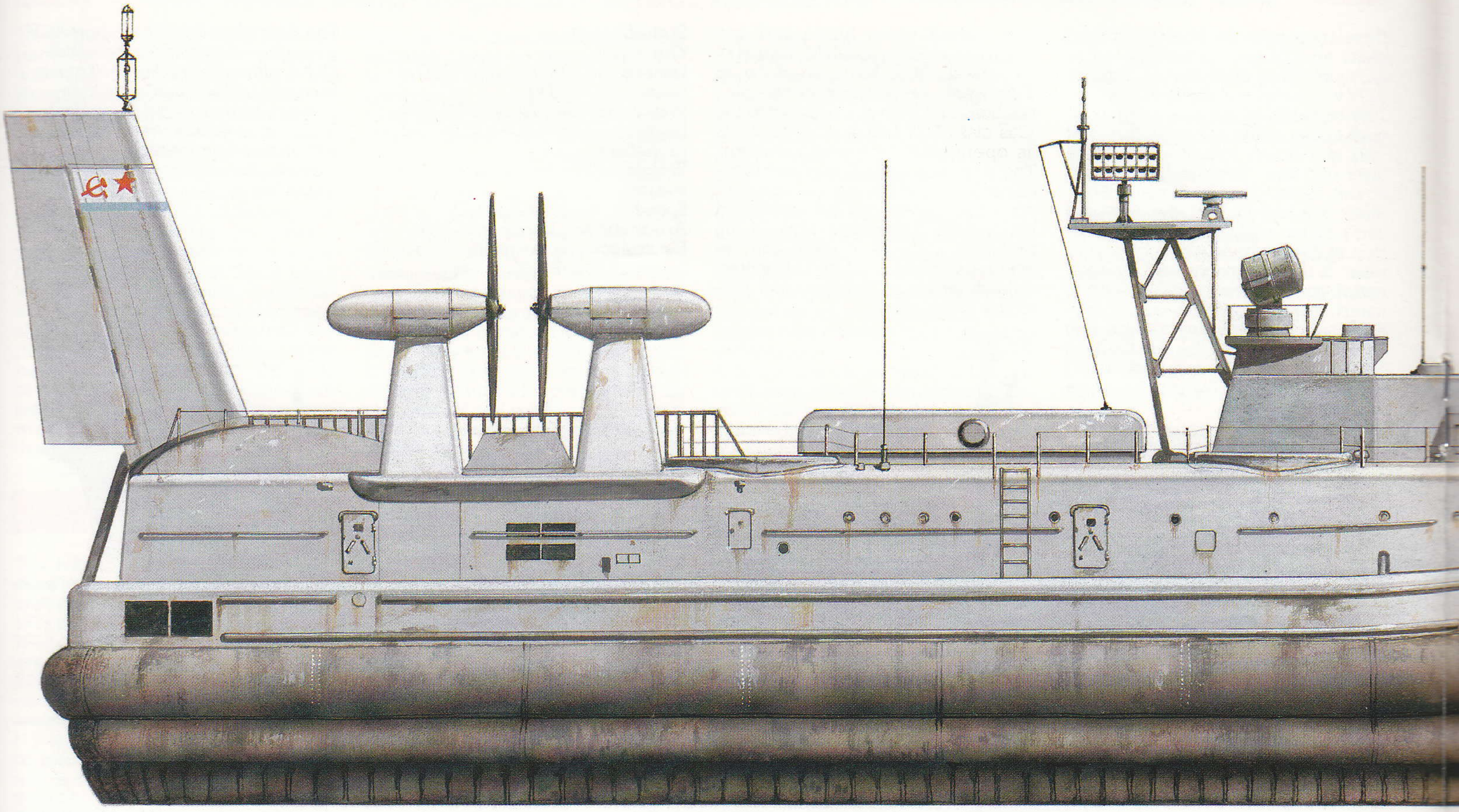
'Aist' class air-cushion vehicle

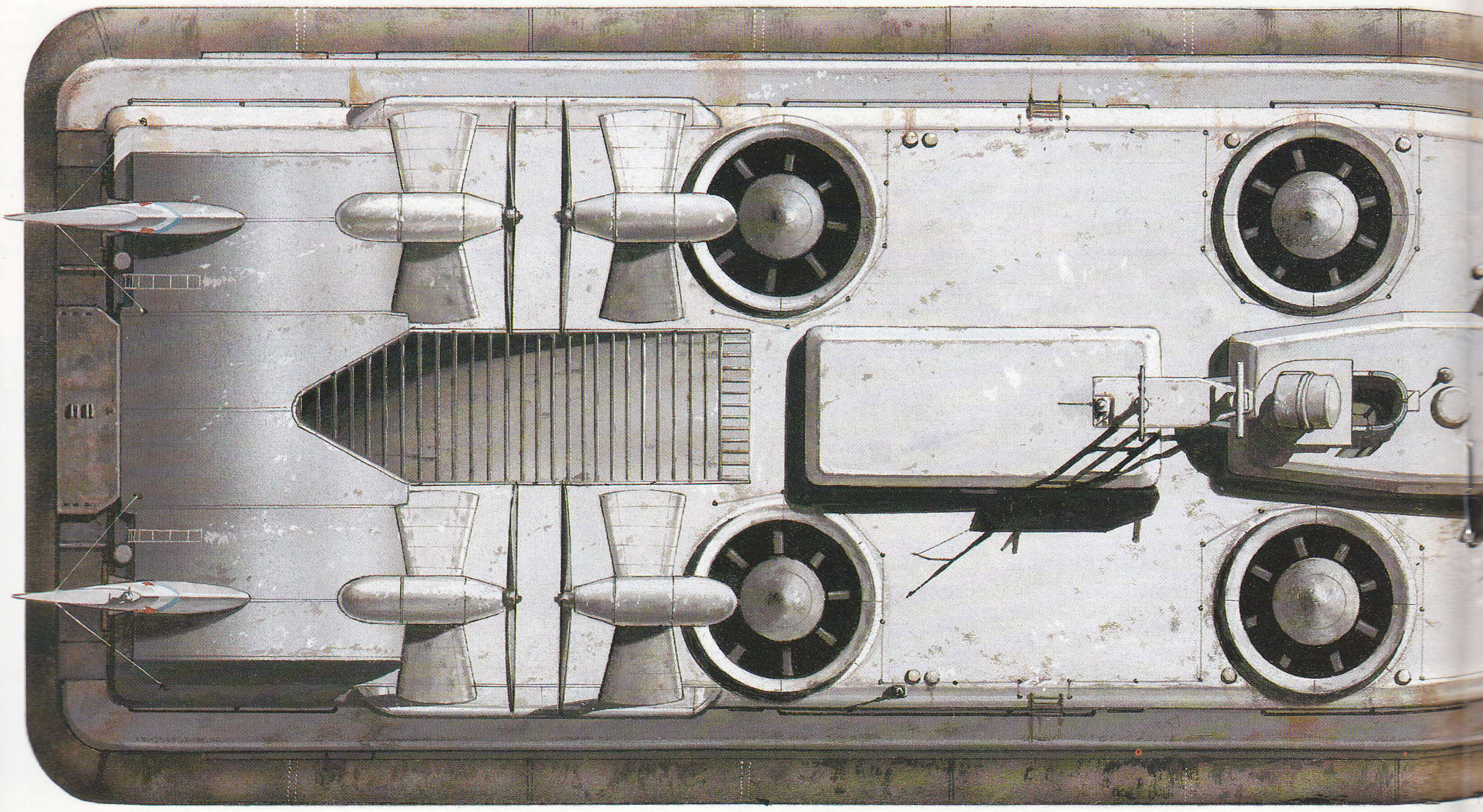
Built at the Leningrad Shipyards, the air-cushion vehicle known to NATO as the **'Aist' class** is the Soviets' first large ACV design, and while similar in general appearance to the British SR.N4 Mk 2 'Mountbatten' class is much heavier. The prototype was launched in 1970 and following extensive testing the class entered series production in 1975. Since then several variants have been built, these differing in fin height, overall length, superstructure detail and armament configuration. Some 17 'Aists' are in service at present, and more are being built. Used as an amphibious assault and logistic supply ACV, the 'Aist' can deliver Naval Infantry, armoured vehicles and supplies to beach-heads which can be well inland. Only two of the Soviet fleets (the Baltic and Black Sea Fleets) deploy the 'Aists', the former having its units extensively photographed by NATO aircraft and ships during Warsaw Pact landing exercises. Large bow and stern loading ramps provide through-ship operations, and typical payloads for the craft are two MBTs of the T-54/T-55/T-62/T-72 or T-74 type, four PT-76 light amphibious tanks and 50 Naval Infantry, three BTR-60/70/BMP-1/2 APCs and 100 Naval Infantry, four trucks and 100 Naval Infantry, 220 Naval Infantry or up to 50 or 60 tons of supplies.

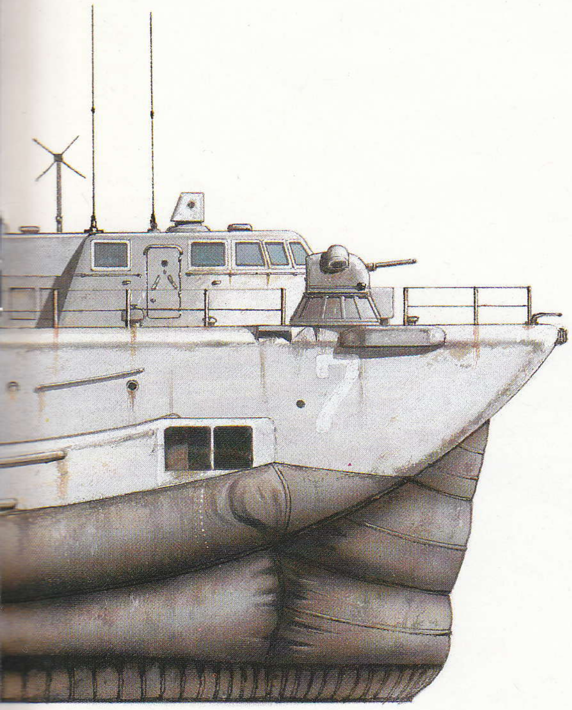
Specification
'Aist' class
Dimensions: length 47.8 m (156.8 ft); beam 17.5 m (57.4 ft)
Propulsion: two 24,000-shp (17894-kW) gas turbines driving four lift fans and four propellers
Weights: maximum 270 tons; payload see text
Speed: 80 kts (60/65 kts normal)
Armament: two twin 30-mm turrets over the bow
Electronics: one 'Spin Trough' navigation radar, one 'Drum Tilt' fire-control radar, one 'High Pole-B' IFF system, and one 'Square Head' IFF system

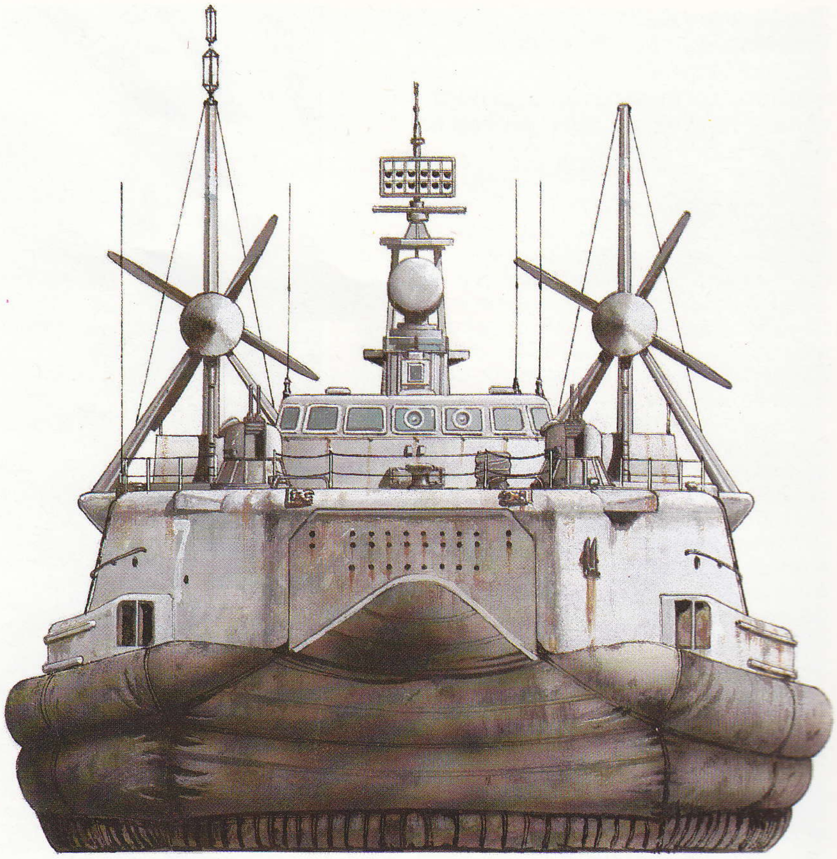
Seen operating with Mil Mi-8 'Hip' helicopters off the Baltic coast of the German Democratic Republic, the Leningrad-built 'Aist' class large amphibious ACV is about the same size as the 'Mountbatten' class used on the English Channel, although giving the impression of being more rugged.

'Aist' class air-cushion vehicle (continued)



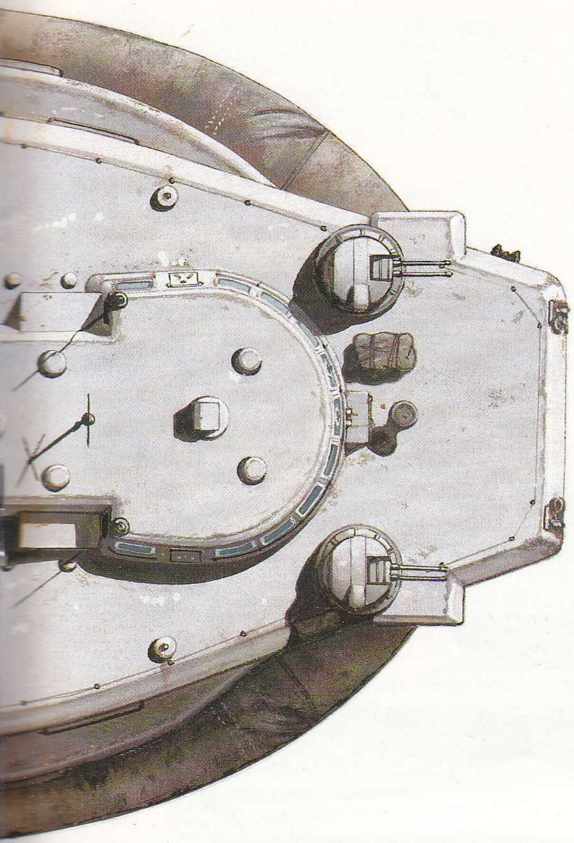


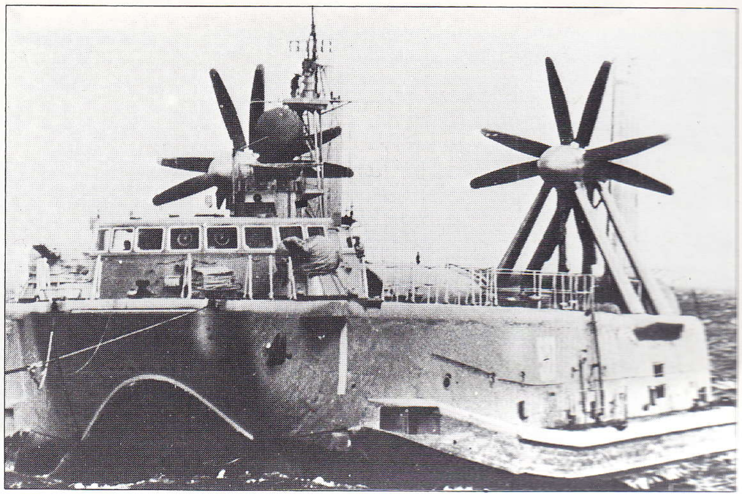




USSR 'Aist' Class Large Naval Air-cushion Vehicle

In service with the Black Sea and Baltic Fleets of the Soviet navy, the 'Aist' class has been in production since 1975 at a rate of approximately two completions per year. A typical load during operations on the Baltic would be two T-72 MBTs and two platoons (60 men) of a naval infantry company. Armament comprises two twin 30-mm DP turrets together with an associated 'Drum Tilt' AA fire control radar.

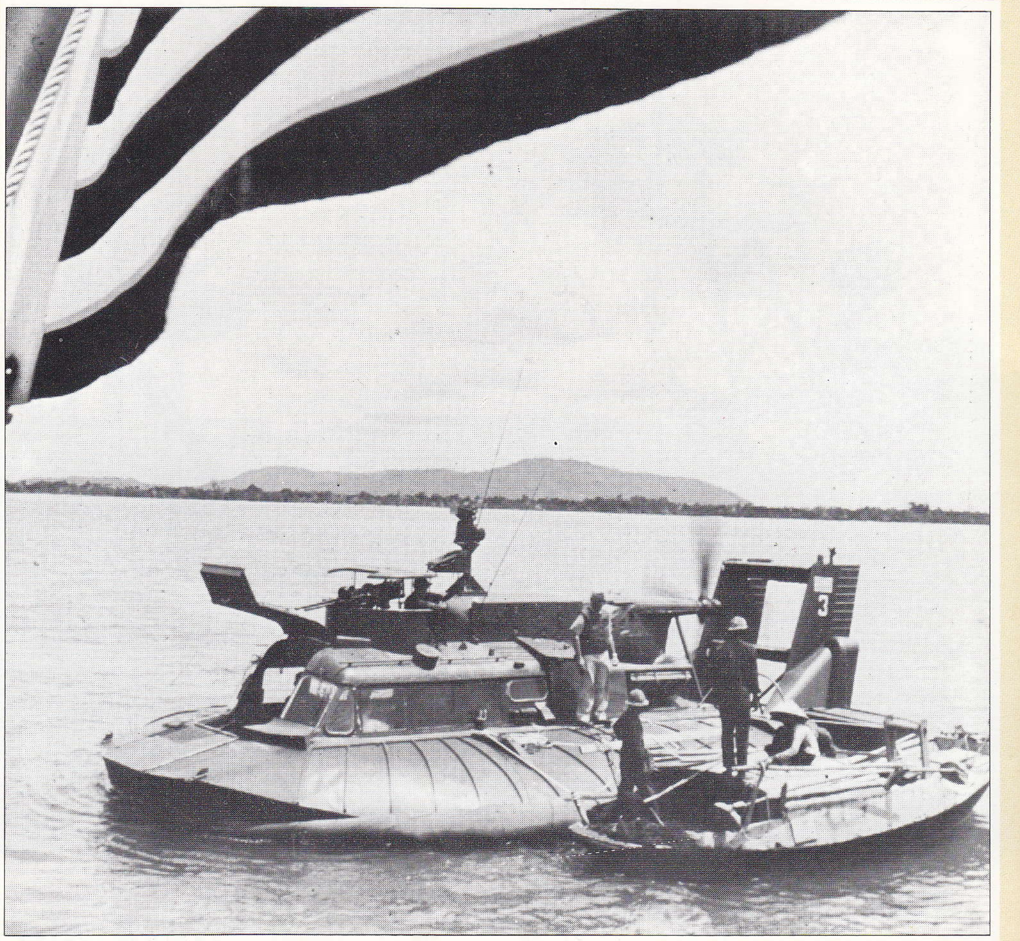




'Aist' class hovercraft are driven by twin marinized NK-12MV gas turbines originally developed by Kuznetsov to power the Tu-95 'Bear' bomber. Earlier models had the engine air intake at the mouth of a long dorsal tunnel, as seen here, but this was later eliminated.

Mekong Monsters

The Mekong Delta is the 'rice bowl' of Vietnam. With five thousand square miles of paddyfields and waterways, it is a tortuous area to navigate in both vehicles and ships, but it proved no obstacle for hovercraft.



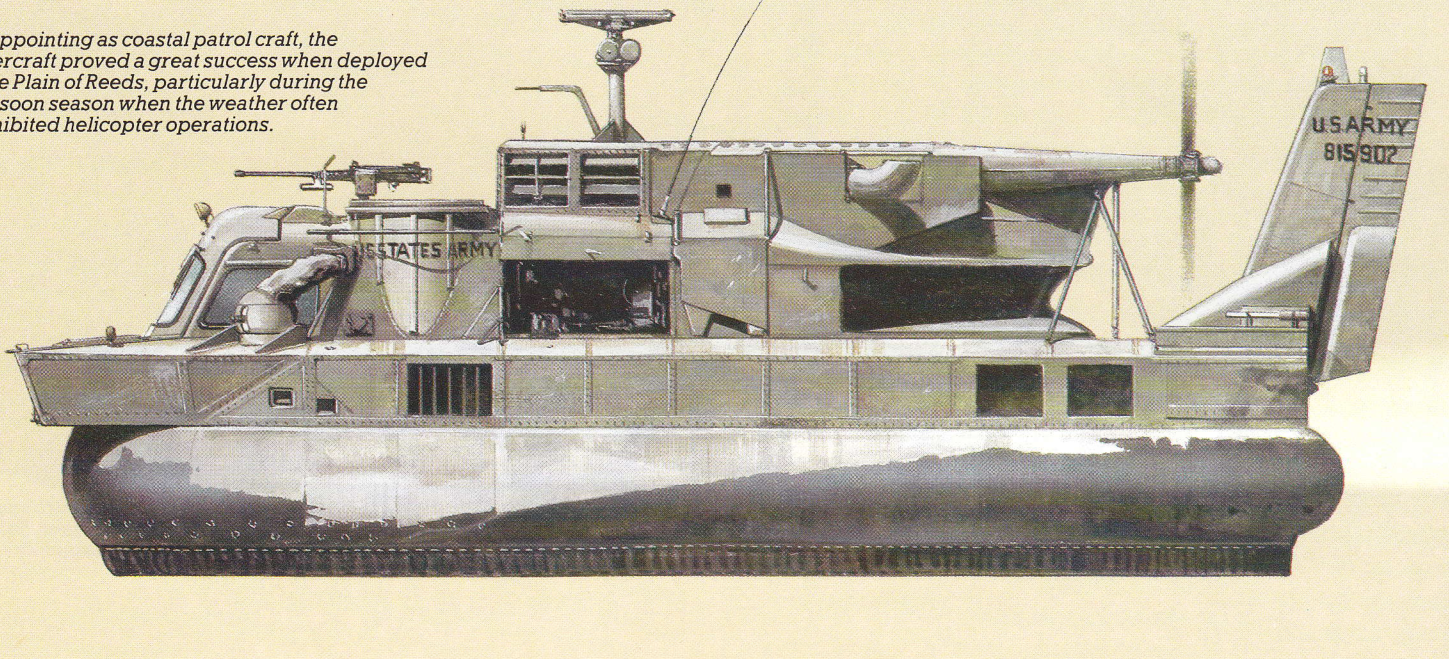
The crew of a Patrol Air Cushion Vehicle (PACV) inspect a sampan for Viet Cong supplies while another PACV stands by. One disadvantage of the craft as an offshore patrol vessel was that in order to stop and search it had to deflate its air cushion, leaving it vulnerable.

During the Vietnam War one of the major areas of concern to the US armed forces was the Mekong delta, a large area to the southwest of the capital, Saigon. This region contains over 3900 km (2,425 miles) of navigable waterways, of which some 1290 km (800 miles) are canals with a mean water depth of 2 m (6.6 ft) at low tide and the remainder natural or improvised waterways spreading out from the Mekong, Vaico, Dong Nai and Saigon rivers. The 13000-km^2 (5,020-sq mile) alluvial basin which forms the delta is bordered to the north by the poorly drained and low-fertility Plain of Reeds with some 5300 km^2 (2,045 sq miles) of its 7000-km^2 (2,700-sq mile) total area actually within the borders of South Vietnam. What was important, however, was that the delta was considered to be the 'rice bowl' of Indochina with an attendant high concentration of population in numerous hamlets and few real towns.

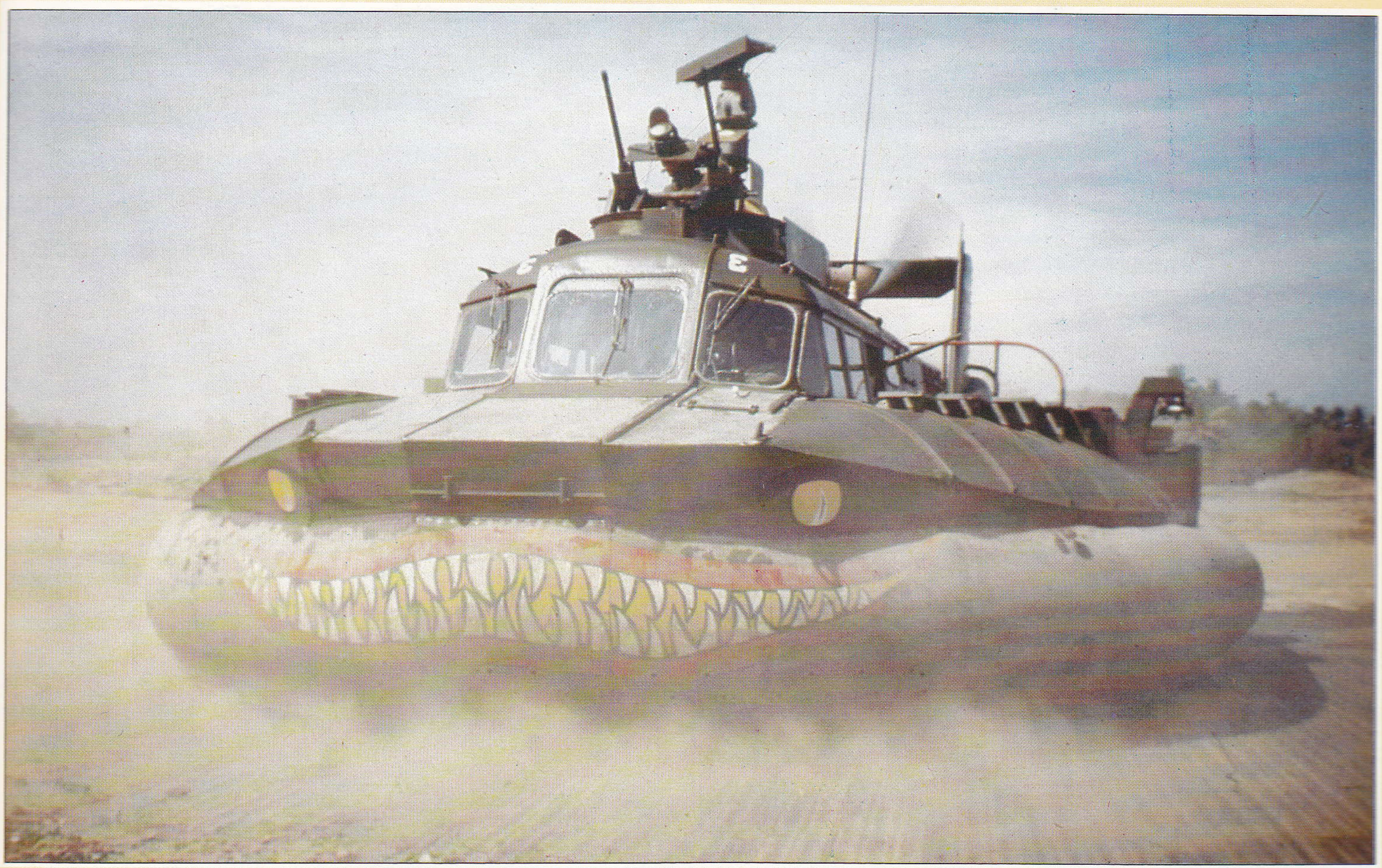
This made the delta a primary objective for the North Vietnamese and local Vietcong both as a major food source and as a recruiting and base camp area. The network of waterways was ideal for supplying guerrilla units and for transporting war materials from Cambodian sanctuary areas to the vicinity of Saigon and some of the towns near it.

Inshore surveillance

In September 1965 Operation 'Game Warden' was initiated, the first US Navy units assigned to it becoming operational in February 1966. Their assigned mission was the provision of inshore surveillance and daylight patrols along the major waterways to reduce to a minimum the Vietcong infiltration and supply operations by junk. Later, as the units gained in experience they were also used to undertake lengthy night patrols, to support the Vietnamese River Force in its operations and to insert and extract 6/10-man SEAL reconnaissance and raiding parties in communist base camp areas. The craft used first was a modified commercial sports boat design designated the PBR Mk 1. This was rapidly followed into service by an enlarged version, the PBR Mk 2. However, it was soon realized that the PBRs were too valuable an asset to commit to the remoter parts of the delta, and surveillance of these areas was left to overflights by helicopters and irregular patrols by South Vietnamese troops in navy assault boats. Not daunted by this, the US Navy began looking at other forms of transportation, among which was the air-cushion vehicle. Of these the most promising appeared to be the Bell Aerosystems SK-5 Model 7255, an 8.5-ton 11.8-m (38.75-ft) long Americanized version of the British SR.N5 design. Accordingly three such vehicles, designated Patrol Air Cushion Vehicles (PACV)-1 to 3, were delivered late in 1965, and over the next four years they were twice deployed to South Vietnam for testing. In the coastal and



Disappointing as coastal patrol craft, the hovercraft proved a great success when deployed to the Plain of Reeds, particularly during the monsoon season when the weather often prohibited helicopter operations.



After their combat debut in Operation 'Quai Vat' ('monster' in Vietnamese), the PACVs adopted the call sign 'Monster' and their crews adorned them with this ferocious shark's-mouth design.

inshore patrol roles they were found to be adequate in terms of mobility, but also much too noisy and requiring considerable maintenance to retain operational status for long periods.

In-country success

Despite this initial disappointment, it was then found that the craft were highly successful when moved in-country to the remote marshy areas of the Plain of Reeds, especially during the wet season when weather conditions severely limited aerial activity. Operating usually in pairs or as a trio (and occasionally as singletons), the PACVs could travel at speeds of up to 55 or 60 kts with a crew of three plus 2 tons of supplies or up to 17 passengers. Apart from their use as high-speed transports and cargo carriers, the PACVs were also used as patrol craft, for which a high-definition surface-search/navigation radar was fitted. The armament varied, although for the final 1968-9 deployment it was officially fixed at a twin 12.7-mm (0.5-in) calibre heavy machine-gun mounting in the cabin roof just aft of the pilot's position, two single 7.62-mm (0.3-in) machine-guns on each side of the cabin in amidships window positions, two 40-mm grenade-launchers, and the various pistols, sub-machine guns and automatic rifles of the embarked personnel. The unfortunate thing was that when searching a suspect junk the PACVs had to come alongside and deflate their skirts in order to maintain position. Following their return from Vietnam in May 1969 they were transferred to the US Coast Guard during October of the same year, and underwent an overhaul in 1970 before starting a period of evaluation as unarmed coastal patrol craft. Once this had finished the craft, called Hover 1-3, were deleted.

In addition to the PACVs, the US Navy and US Marine Corps also evaluated in the late 1960s and early 1970s 10 Chrysler Corporation Riverine Utility Craft (RUC), whose propulsion was based on the marsh (or Archimedes) screw concept (two propelling cylinders fitted with helical vanes mounted on the craft's underside on the fore-and-aft axis). The 6.1 m (20-ft) long 6.25-ton petrol-engined RUCs could travel over deep swamps, marshes, rice paddies as well as water or dry land, but were

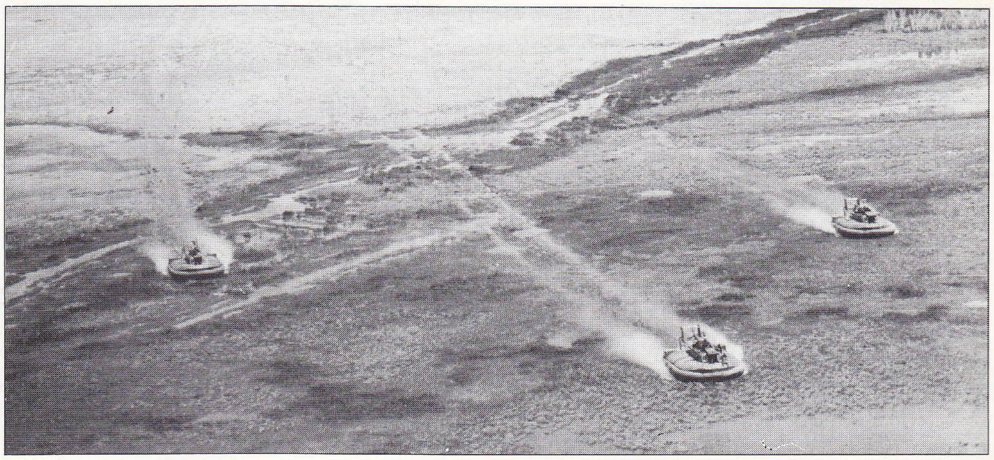
Operation 'Quai Vat' in progress, 21 November 1966: a captured Viet Cong guerrilla is taken aboard by US Navy personnel near Moc Hoa in the Plain of Reeds. Seventy sampans and a similar number of dwellings were destroyed, with 11 prisoners taken and 23 enemy KIA.

significantly limited in the height of obstacles they could climb. A maximum ground speed of 10 to 12 kts was possible, though in water this was reduced somewhat. The payload was either 1 ton of supplies or six fully-equipped troops in addition to its crew of two enlisted men. If required, an armament of one 7.62-mm medium machine-gun and one 40-mm grenade-launcher could be mounted for use alongside the crew's and passengers' own personnel weapons. In this configuration it was possible to mount limited offensive actions.

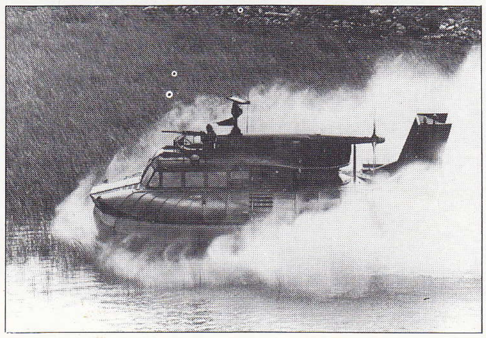
No further development

Surprisingly, throughout the Vietnam War the ACV remained an experimental craft, and after the type's retirement in 1969 ACVs were not developed further even though the question of their relative usefulness in comparison with helicopters had not been answered in full. In many quarters it was felt that coastal patrol roles could be adequately covered by the readily-available helicopter without any significant loss in operational efficiency.

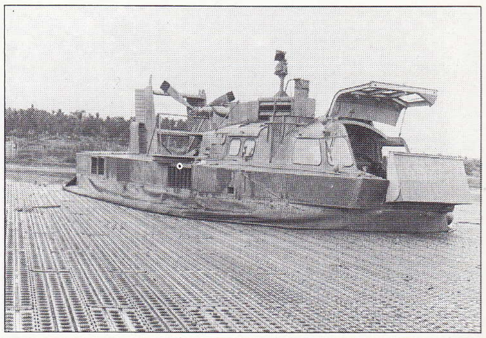
The usefulness of ACVs (especially in logistical roles) was not forgotten, however, and during the 1970s the ACV was resurrected in the form of the JEFF(A) and JEFF(B) prototypes for use as landing craft. For the other answers it remains to be seen what the Soviets and Chinese can do, for these are now the largest users of military hovercraft in the world. As such they will not stand by and let a new concept in warfare stagnate, but will strive to explore all its possibilities if only to justify the large amounts of money and effort they have expended in developing the technology.



Above: The three Patrol Air Cushion Vehicles skim over land and sea alike. They proved able to move at speed through vegetation two metres high and clear ditches up to four metres across, much to the discomfiture of the Viet Cong, who had dominated the Plain of Reeds for many years.



Above: A PACV kicks up a dramatic cloud of mud and spray as it manoeuvres across a marsh near the Cambodian border in search of the elusive Viet Cong. The single 0.50-cal machine-gun seen here was soon supplemented by 0.3-cal weapons and 40-mm grenade-launchers.

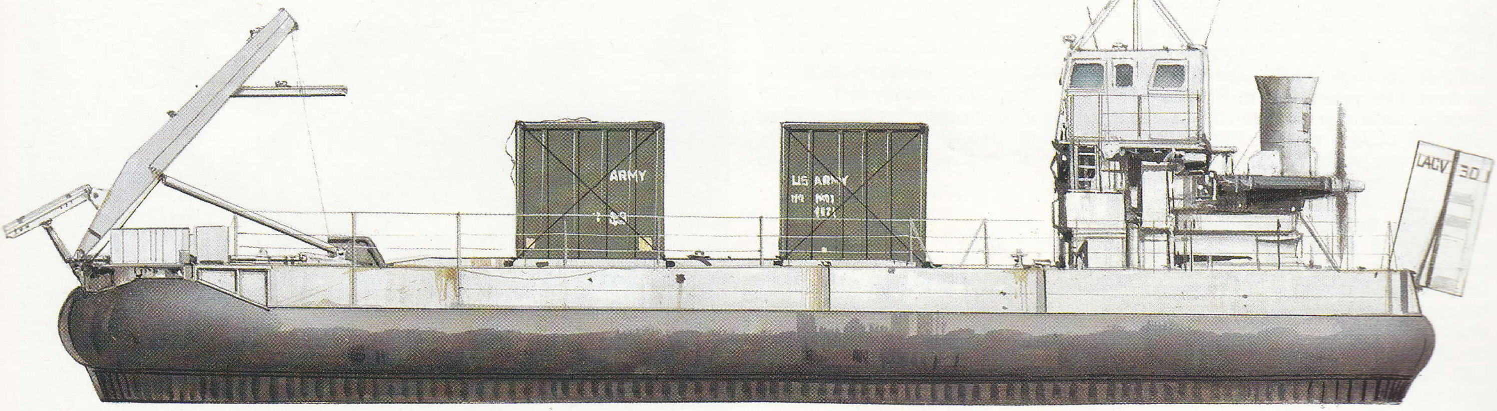


Above: The original PACVs were withdrawn in 1969, but Bell built three hovercraft to a US Army specification and flew them to Vietnam for combat evaluation. This machine operated with the 9th Infantry Division in the summer of 1968. Note the slab sides, which distinguish it from the PACVs.

Below: The PACVs roar beneath the bridge at An Long en route for Cat Lo after the action in the Plain of Reeds. The PACVs gave a creditable performance, but their price tag was against them; each one cost nearly $1m and their running costs were phenomenal.

USA

Bell Model 7467 LACV-30

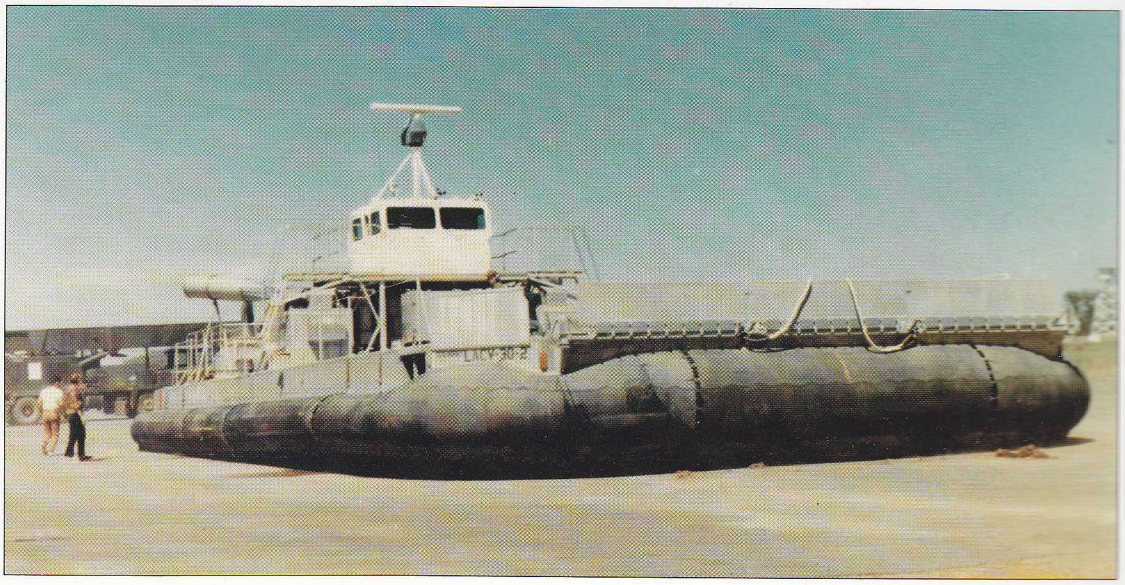


The **LACV-30** (Lighter Air-Cushion Vehicle 30-short ton payload) is a stretched version of Bell Aerospace Textron's Voyageur civilian model. A total of 24 of these vehicles (company designation **Bell Model 7476**) is in the process of being delivered to replace the wheeled LARC-5 and LARC-15 (Lighter Amphibious Resupply Cargo 5 and 15-ton) models currently in service with the US Army's light and medium amphibian companies. The new craft will be used as high-speed amphibious vehicles for LOTS (Lighter-Over-The-Shore) operations where no port facilities exist. The LACV-30 can travel over water, land, snow, ice, marshes, swamps, low brush and other small obstacles or through 2.44-m (8-ft) high surf carrying a variety of containerized cargo, wheeled or tracked vehicles, heavy engineering plant or other supplies such as fuel and water containers. It can be carried fully assembled on a ship, be launched by the crew and be fully operational within several hours or, alternatively, it can be broken down into 15 sections for carriage by truck, rail or aircraft and then reassembled at its destination. In the simple drive-on/drive-off role using its bow ramp the craft can carry the maximum load of 30 tons with an endurance of 2 hours. If, however, it is used as a self-unloading platform for supplies via its swing crane in the bows the load is reduced to 26.5 tons though endurance remains the same. Other roles (such as medical evacuation, troop transport and water or fuel resupply) give greater endurance, times of between 5 and 9 hours being possible depending upon the actual payload figure.

Specification

LACV 30
Dimensions: length 23.32 m (76.5 ft); beam 11.18 m (36.7 ft)
Propulsion: two 1,800-shp (1342-kW) gas turbines driving two lift fans and two propellers
Weights: maximum 51.34 tons; payload see text
Speed: 33.5 kts (normal)
Electronics: one navigation radar

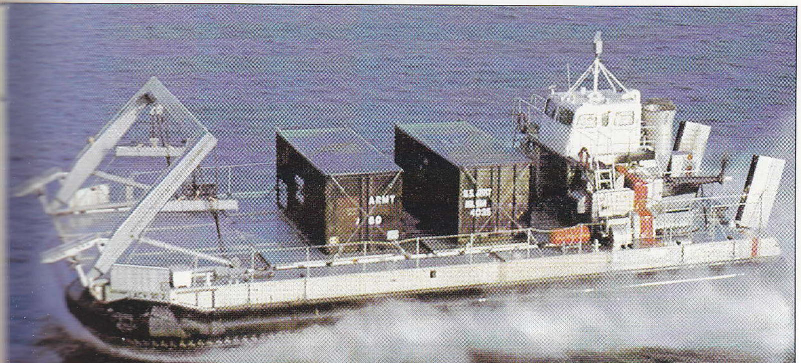
The Bell Aerospace Canada Textron Voyageur heavy-haulage ACV was developed in 1971, and was used as the basis for development of the US Army's LACV-30.

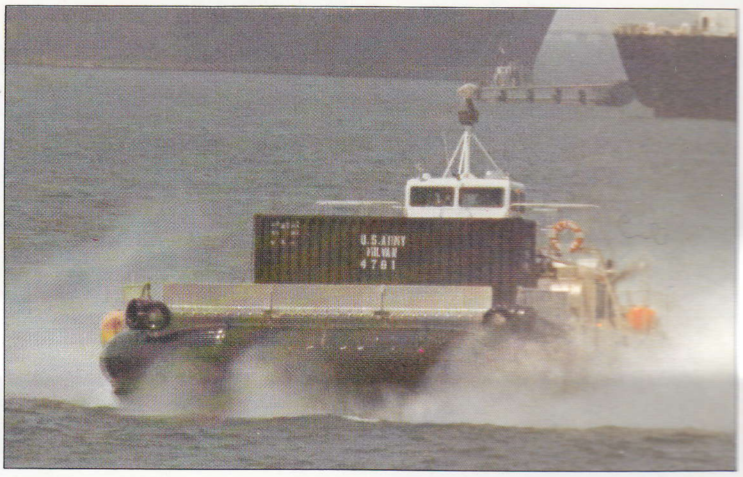


Below: The LACV-30 is much more efficient than previous LOTS (Lighter Over The Shore) systems, and will eventually replace the LARC-5 and LARC-15 amphibious vehicles currently in service. Secondary roles could include coastal, harbour and riverine patrol, search and rescue and fire control.

Below: Operable over an enormous variety of terrains from the Arctic to the tropics, the LACV-30 can ensure dry landing of the wide range of cargoes carried. These can include ISO containers, tracked and wheeled vehicles, engineering equipment, pallets and barrels, water, fuel, fire-fighting equipment or troops.

Above: The first of 30 LACV-30s was delivered to MERADCOM (the US Army's Mobility Equipment Research and Development Command) in 1981. Unlike the same company's LCAC, the LACV is not an assault craft but is designed to be used solely for the transportation of goods from ship to shore.





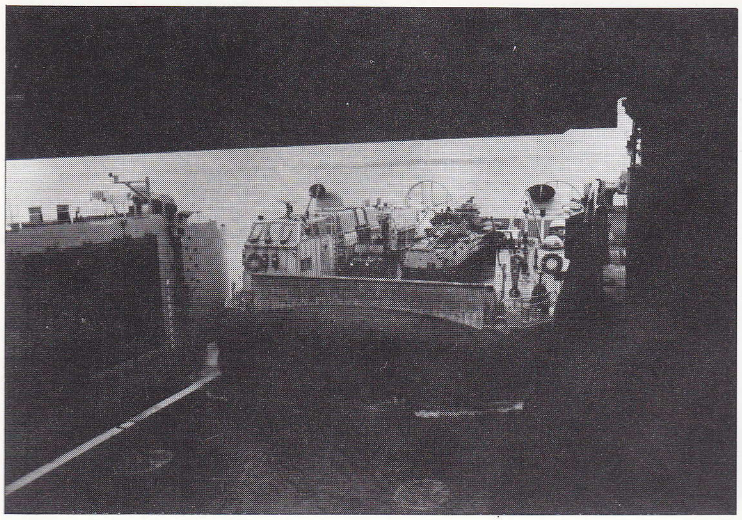
USA

Landing Craft Air Cushion (LCAC)

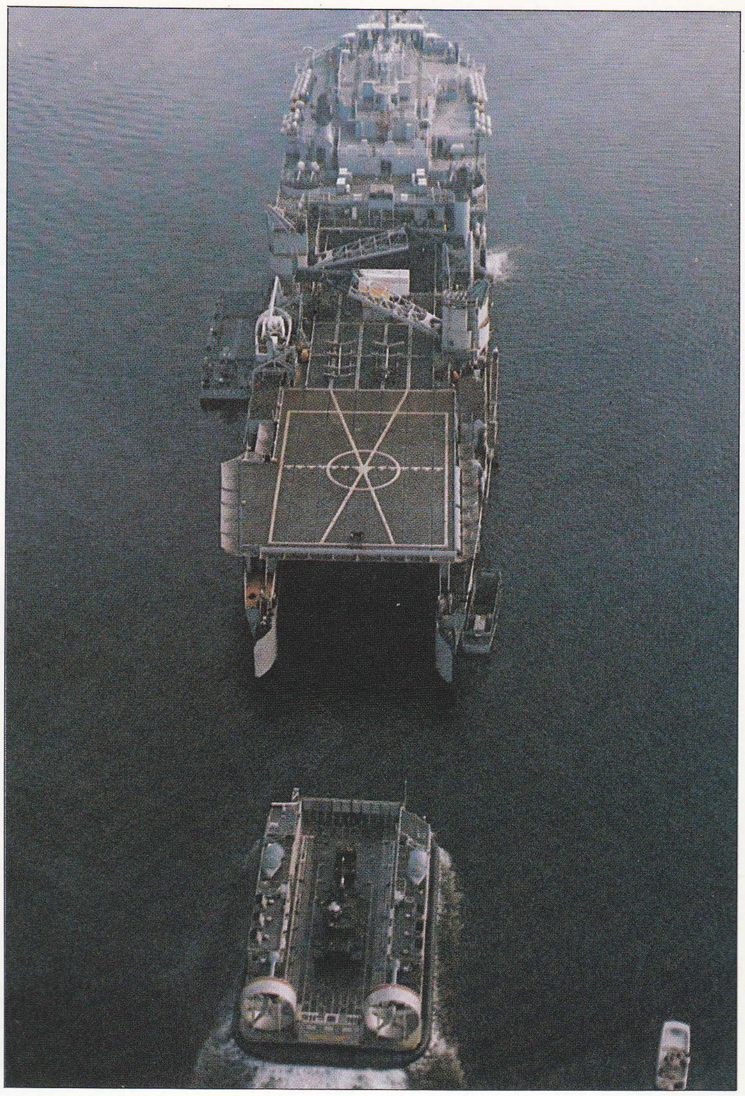
The **Bell Aerospace Textron LCAC** is the definitive production version of the **JEFF(B)** amphibious assault landing craft that was tested alongside the Aerojet-General JEFF(A) prototype for over five years by the US Navy. Incorporating the best attributes of both, 107 LCACs were to have been built, but this has been cut to about 90, of which some 45 are to be based at the Little Creek Naval Amphibious Base, Virginia for the Atlantic Fleet and the remaining 45 at the US Marine Corps base at Camp Pendleton, California for the Pacific Fleet. The LCACs are being deployed in units of six to amphibious squadrons (PHIBRONS) and will be carried by the LHA, LPD, LHD and LSD classes (one, two, three and four craft respectively) to the disembarkation points. The open cargo deck area is 168.06 m^2 (1,809 sq ft) in area and capable of accommodating 60 tons of cargo under normal conditions or up to 75 tons in the maximum overload state with a consequent decrease in performance. Typical loads include a 52-ton M60A1 MBT with five loaded jeeps, or a complete howitzer battery of six 105-mm/155-mm (4.13-in/6.1-in) guns and their loaded truck tractors and crews. The LCAC is fully skirted and can clear land obstacles up to 1.22 m (4 ft) high. Bow and stern ramps are fitted to allow ease of loading and unloading.

Specification
LCAC

Dimensions: length 26.82 m (88.0 ft); beam 14.33 m (47.0 ft)
Propulsion: four 3,070-shp (2289-kW) gas turbines driving four lift fans and two propellers
Weights: maximum 170 tons; payload see text
Speed: 50 kts, or 40 kts with maximum payload
Armament: small arms
Electronics: one surface-search/navigation radar



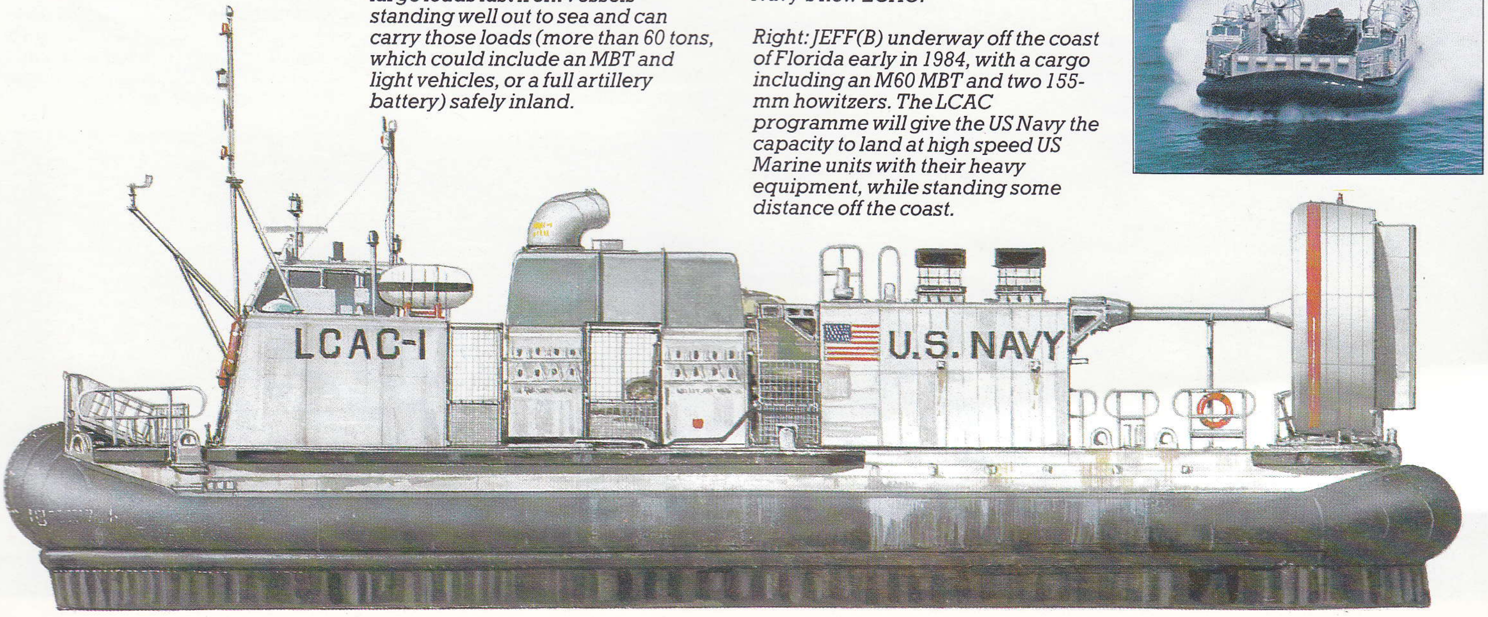
The first production LCAC enters the well deck of USS Pensacola *(LSD 38) during the first underway mating of an LCAC and an LSD. The LCAC carries an M60 MBT, an M151 Jeep and an LAV-25 Light Armored Vehicle.*



Above: Operating off the coast of Florida, the Bell Aerospace Textron AALC (Amphibious Assault Landing Craft) JEFF(B) approaches the docking well of the Landing Ship Dock USS Spiegel Grove. *The JEFF(B) formed the prototype for the US Navy's new LCAC.*

Right: JEFF(B) underway off the coast of Florida early in 1984, with a cargo including an M60 MBT and two 155-mm howitzers. The LCAC programme will give the US Navy the capacity to land at high speed US Marine units with their heavy equipment, while standing some distance off the coast.

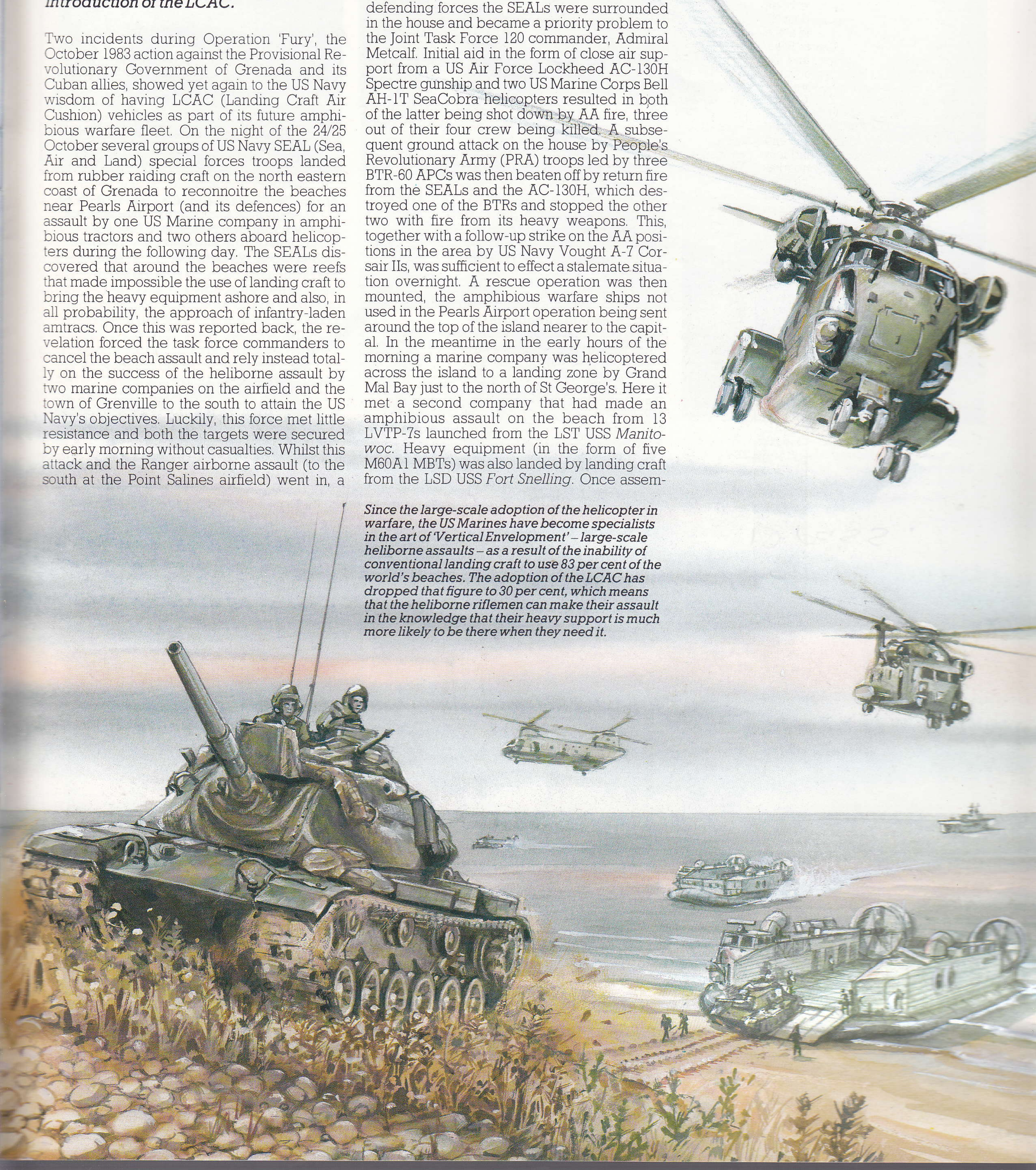
Below: With a range of 300 nautical miles (approximately 550 km) at a speed of 35 kts, the LCAC can ferry large loads fast from vessels standing well out to sea and can carry those loads (more than 60 tons, which could include an MBT and light vehicles, or a full artillery battery) safely inland.



Marine Corps Assault

As a result of the Pacific campaigns of World War II, the USA has an unparalleled amphibious warfare capacity. That capability is about to be dramatically enhanced with the introduction of the LCAC.

Two incidents during Operation 'Fury', the October 1983 action against the Provisional Revolutionary Government of Grenada and its Cuban allies, showed yet again to the US Navy wisdom of having LCAC (Landing Craft Air Cushion) vehicles as part of its future amphibious warfare fleet. On the night of the 24/25 October several groups of US Navy SEAL (Sea, Air and Land) special forces troops landed from rubber raiding craft on the north eastern coast of Grenada to reconnoitre the beaches near Pearls Airport (and its defences) for an assault by one US Marine company in amphibious tractors and two others aboard helicopters during the following day. The SEALs discovered that around the beaches were reefs that made impossible the use of landing craft to bring the heavy equipment ashore and also, in all probability, the approach of infantry-laden amtracs. Once this was reported back, the revelation forced the task force commanders to cancel the beach assault and rely instead totally on the success of the heliborne assault by two marine companies on the airfield and the town of Grenville to the south to attain the US Navy's objectives. Luckily, this force met little resistance and both the targets were secured by early morning without casualties. Whilst this attack and the Ranger airborne assault (to the south at the Point Salines airfield) went in, a number of special forces operations were being conducted. One involved the rescue by 22 SEALs of the island's British-appointed governor from his official residence on the outskirts of the capital, St George's. As a result of the unexpected strength and reaction of the defending forces the SEALs were surrounded in the house and became a priority problem to the Joint Task Force 120 commander, Admiral Metcalf. Initial aid in the form of close air support from a US Air Force Lockheed AC-130H Spectre gunship and two US Marine Corps Bell AH-1T SeaCobra helicopters resulted in both of the latter being shot down by AA fire, three out of their four crew being killed. A subsequent ground attack on the house by People's Revolutionary Army (PRA) troops led by three BTR-60 APCs was then beaten off by return fire from the SEALs and the AC-130H, which destroyed one of the BTRs and stopped the other two with fire from its heavy weapons. This, together with a follow-up strike on the AA positions in the area by US Navy Vought A-7 Corsair IIs, was sufficient to effect a stalemate situation overnight. A rescue operation was then mounted, the amphibious warfare ships not used in the Pearls Airport operation being sent around the top of the island nearer to the capital. In the meantime in the early hours of the morning a marine company was helicoptered across the island to a landing zone by Grand Mal Bay just to the north of St George's. Here it met a second company that had made an amphibious assault on the beach from 13 LVTP-7s launched from the LST USS *Manitowoc*. Heavy equipment (in the form of five M60A1 MBTs) was also landed by landing craft from the LSD USS *Fort Snelling*. Once assembled ashore the combined force moved on to relieve Government House at 07.00, meeting little resistance on the way save from a BRDM-2 armoured car which was demolished by a round from one of the tanks.



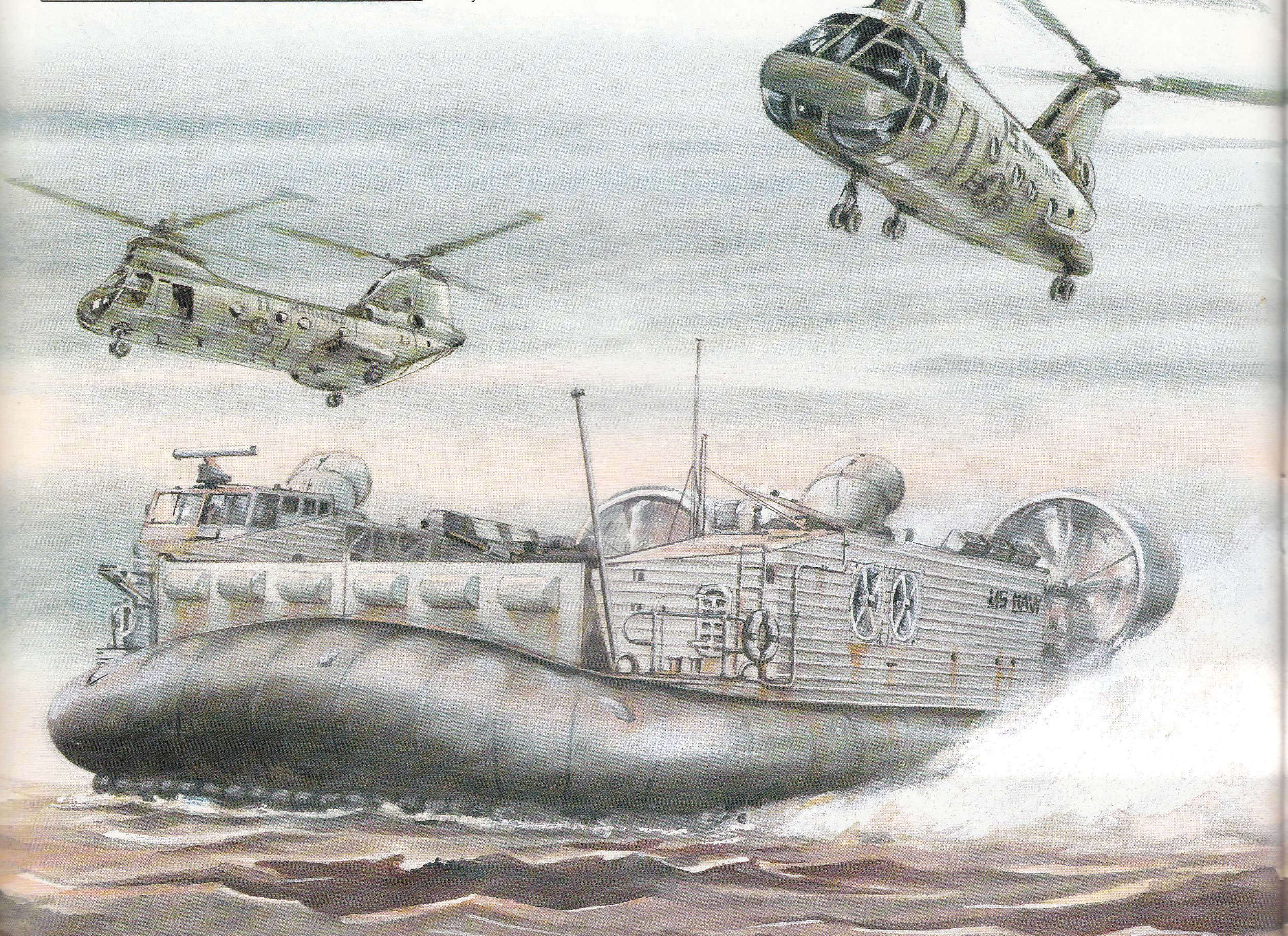
Since the large-scale adoption of the helicopter in warfare, the US Marines have become specialists in the art of 'Vertical Envelopment' – large-scale heliborne assaults – as a result of the inability of conventional landing craft to use 83 per cent of the world's beaches. The adoption of the LCAC has dropped that figure to 30 per cent, which means that the heliborne riflemen can make their assault in the knowledge that their heavy support is much more likely to be there when they need it.

FOR SALE
PRIME LOTS

Above: Helicopters have revolutionized warfare, but remain extremely vulnerable to determined opposition. In the US operation to take Grenada, numbers of UH-60 Black Hawks and AH-1s were shot down by Cubans.

Left: To the SEALs trapped in the Governor's house, Soviet-built BTR-60 APCs were a real threat, but had LCACs been available the original beach landing would have gone ahead, and the rescue mission would have had M60 tanks with it all the way.

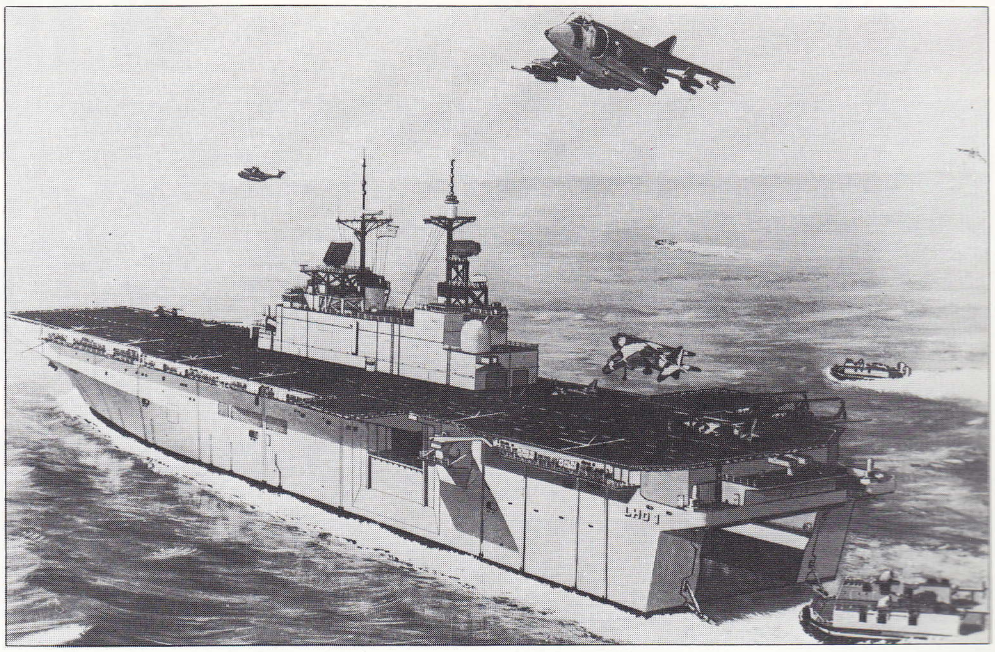
Above: The Grenada operation proved once more the difficulty in attacking vigorously-defended positions, with the lightly-armed People's Revolutionary Army and their Cuban advisers putting up stiff resistance against overwhelming US power.



These episodes showed to the US Navy that the presence of a few LCACs aboard the landing ships would have allowed the landing on D-day at the beach near Pearls Airport to continue without hindrance from the reef obstacles, with considerable tactical surprise to the defenders as they obviously thought such an operation impracticable. In addition, the range and speed of the new craft would also have allowed the rescue landing to take place much more quickly and without the need to move the landing ships too far from their original position. The added bonus would have been that heavy equipment such as tanks could also have been taken ashore by the LCACs at the same time. In fact the LCAC by virtue of its independence of tidal and hydrographic conditions has increased the percentage of the world's beaches available to amphibious landings from 17 to 70 per cent. The LCAC's advantages in payload, speed, range, surprise effect and across-the-beach capability will also allow 50 per cent more tonnage of combat equipment and supplies to be delivered in a given time when compared with conventional hull-type landing craft. This is even more remarkable when it is realized that the latter are operating from vessels in a highly vulnerable position but less than 10 km (6.2 miles) offshore, whereas the former would shuttle from vessels relatively safely positioned up to 50 km (more than 31 miles) out to sea. It should also be noted that the LCAC will be working in conjunction with a variety of other platforms such as the Sikorsky CH-53E Super Stallion heavy-lift helicopter able to carry a 16-ton payload over the same ship-to-shore distance, the tilt-rotor Bell MV-22A Osprey medium-lift aircraft which is to replace the elderly Boeing-Vertol CH-46 Sea Knight helicopter, and the upgraded LVTP-7A1 and new LVT-8 amphibious assault armoured personnel carriers.

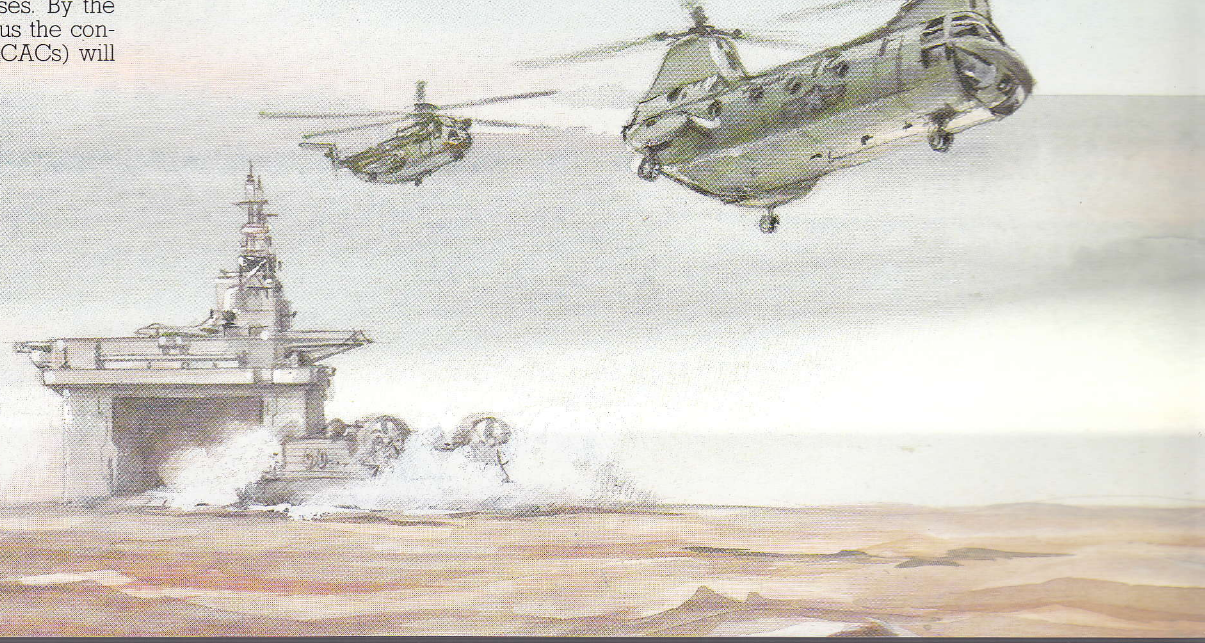
The Osprey is particularly important as a force-builder in the Amphibious Operational Area (AOA) as it will be able to make two separate 460-km/h (286-mph) deliveries of 24 fully equipped marines to a landing zone 48 km from the host ship within 90 minutes and without the need to refuel. In addition it is capable of self-deployment throughout the world using inflight-refuelling if needed. With first deliveries due in 1991, the ultimate fleet goal is 16 active and two reserve MV-22A squadrons.

To ensure that the LCACs get to assigned AOAs, the US Navy has begun procurement of the 'Whidbey Island' or 'LSD-41' and the 'Wasp' or 'LHD-1' dock landing ship classes. By the mid-1990s this new-build effort (plus the conversion of existing ships to take LCACs) will give the US Navy and US Marine Corps the strategic lift capacity to deliver several Marine Air-Ground Task Forces (MAGTF) of brigade or divisional size simultaneously in several parts of the world.



Above: USS Wasp*, first of the new LHD class which will be optimized for LCAC operations, is scheduled for delivery in 1989. Slightly larger than the 'Tarawa' class, these 40,000-ton vessels will replace the much smaller 'Iwo Jima' class on a one-for-one basis.*

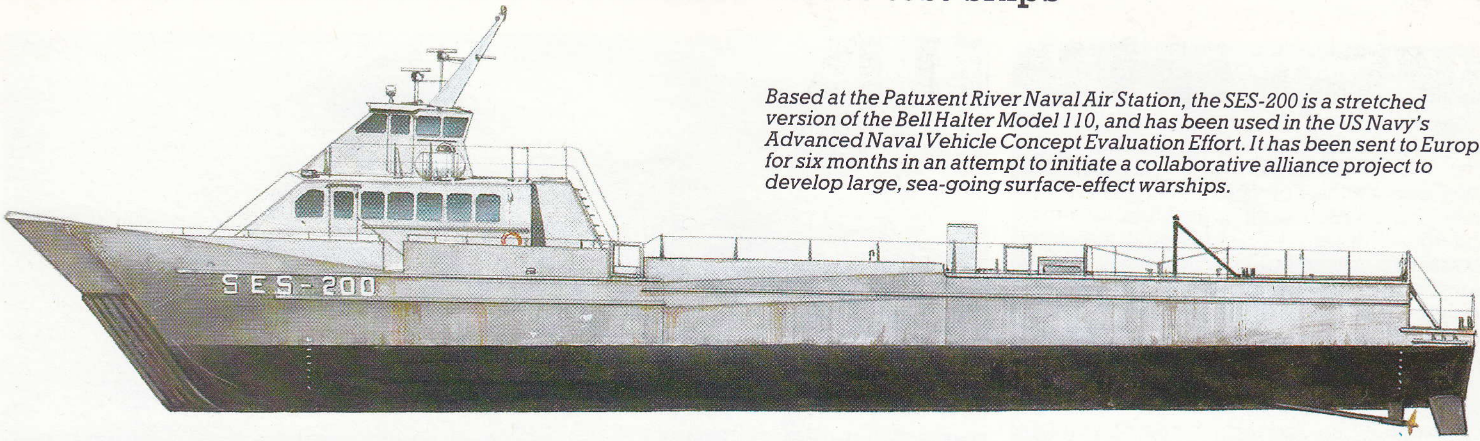
Left: At the heart of the change which is to sweep through US amphibious capability in the next decade, the air-cushioned landing craft may well be the most significant development in the field since the introduction of the original assault vessels during World War II.



The revolution in US Marine operations is taking place in stages: the Light Armored Vehicle and the LCAC entering service now, the new amphibious tracked vehicle in the next few years, the 'Wasp' class LHD in the early 1990s, and the MV-22 tilt rotor aircraft at about the same time (replacing the venerable CH-46 Sea Knight). The ACV is central to the new style of operations, as the Marines think that the vessels of an assault force may have to stand off at least 40 km (25 miles) from any defended shoreline.

USA

Bell SES-100B and SES-200 surface-effect test ships



Based at the Patuxent River Naval Air Station, the SES-200 is a stretched version of the Bell Halter Model 110, and has been used in the US Navy's Advanced Naval Vehicle Concept Evaluation Effort. It has been sent to Europe for six months in an attempt to initiate a collaborative alliance project to develop large, sea-going surface-effect warships.

The **Bell Aerospace Textron SES-100B** was part of a long-term US Navy programme to develop large ocean-going ships with speeds of 80 kts or more for military uses. Stemming from research begun in 1960 and the experimental 17-ton XR-1 which was completed in 1963 with a top speed of 34 kts, the 92-kt 100-ton 23.7-m (77.75-ft) SES-100B was launched in 1971 and used together with Aerojet-General's SES-100A 75-kt 110-ton 24.4-m (80-ft) long craft through the 1970s to test performance, stability and sea-keeping characteristics, structural loadings and the various operational tasks that a Surface-Effects Ship might undertake. In April 1976 the SES-100B travelling at 60 kts successfully fired a vertically-launched RIM-66B Standard SM-1MR air-defence missile against a surface target moored some 9.7 km (6 miles) away. The SES-100A was subsequently scrapped in 1982 after the evaluation had been finished, whilst the SES-100B was placed on static display at the David W. Taylor Naval Research and Development Center, Annapolis in the same year. The latest US Navy SES research vessel is the **Bell Halter SES-200 Model 730A** which was modified in 1982 from the **Bell Halter 110 Model 210A** demonstration SES after trials with the US Coast Guard as the USCG *Dorado* (WSES-1), the USCG then buying three units similar to the original. The main change involved a 15.24-m (50-ft) insert in the hull in order to increase the available fuel load and to allow the US Navy to assess the performance of a higher length-to-beam ratio. The aft decking was also strengthened to allow helicopter operations. The SES-200 was shipped to Europe in January 1986 for an eight-month technical demonstration period for various NATO navies.

Specification

SES-200

Dimensions: length 48.77 m (160.0 ft); beam 11.88 m (39.0 ft); draught 1.7 to 2.6 m (5.5 to 8.5 ft)

Propulsion: two 1,600-hp (1193-kW) diesels driving two propellers and two 445-hp (332-kW) diesels driving two lift fans

Weights: maximum displacement 200 tons; payload see text

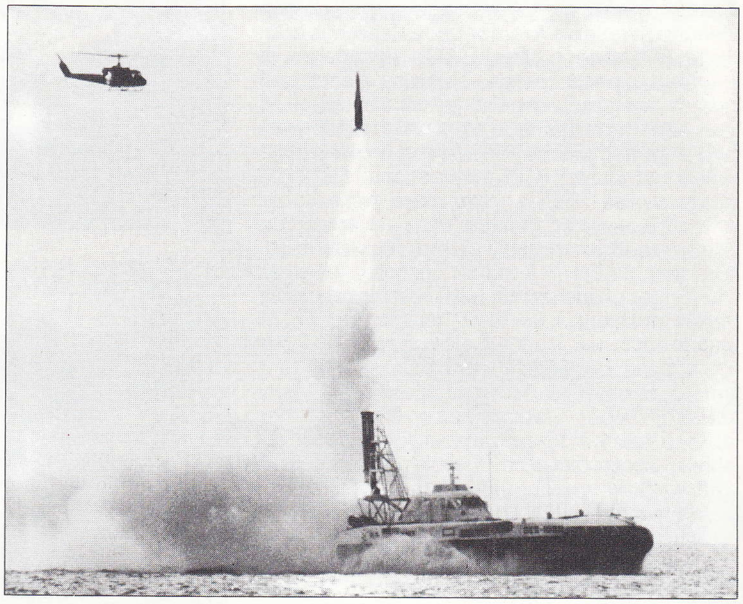
Speed: 32 kts

Armament: none

Aircraft: provision for one helicopter

Electronics: one surface-search/navigation radar

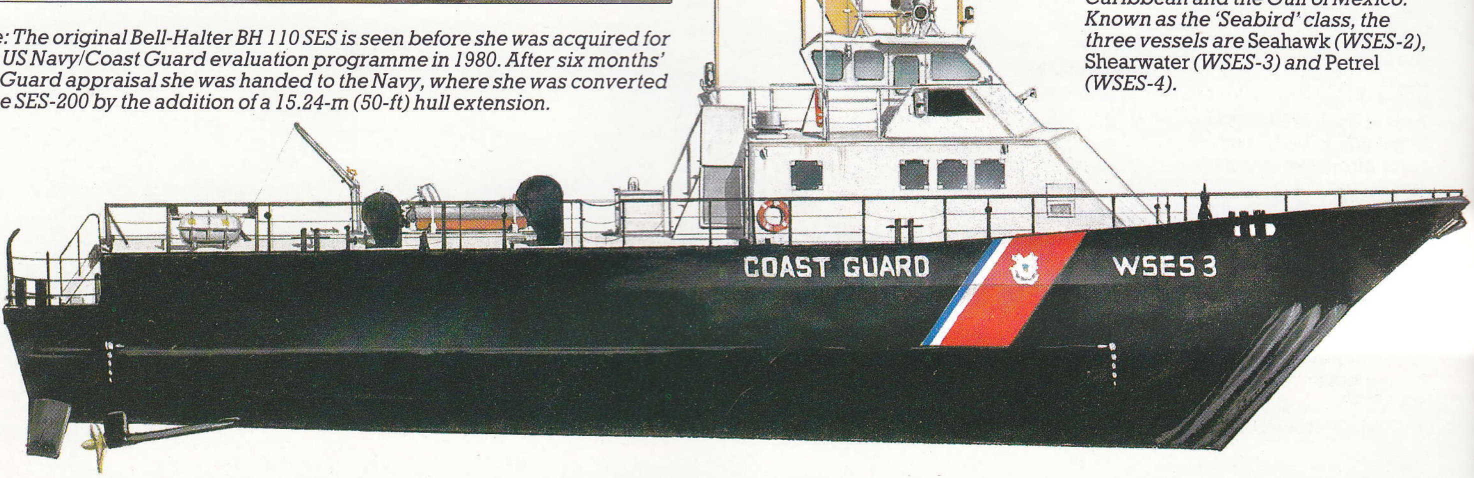
Complement: 13



The pioneer US Navy surface-effect vessel, SES-100B, is seen in April 1976 when she launched an SM-1 Standard surface-to-air missile while making a steady 60 kts. It was also the first vertical launch of the SM-1 from any ship. On 27 January 1980, SES-100B set a surface effect vessel speed record of 91.9 kts (170.25 km/105.8 miles) per hour.

BELL-HALTER SES

Above: The original Bell-Halter BH 110 SES is seen before she was acquired for a joint US Navy/Coast Guard evaluation programme in 1980. After six months' Coast Guard appraisal she was handed to the Navy, where she was converted into the SES-200 by the addition of a 15.24-m (50-ft) hull extension.



Following the successful six-month trial of the BH 110, the US Coast Guard ordered three similar vessels for use out of Key West, Florida, in the war against drug-smuggling in the Caribbean and the Gulf of Mexico. Known as the 'Seabird' class, the three vessels are Seahawk *(WSES-2),* Shearwater *(WSES-3) and* Petrel *(WSES-4).*

Denmark

In time of war Denmark would have a vital role to play in the defence of the West as it is situated on the approaches to the Baltic through which the Soviet Baltic Fleet (which is known to have more than 30 conventional and nuclear submarines, surface craft, many amphibious warfare vessels and over 20 hovercraft) would have to pass.

Denmark has a population of just over five million and its armed forces have a peacetime strength of 31,000 officers and men of whom 9,800 are conscripts doing their nine months' national service.

The Danish forces are being modernized, with the air force receiving the bulk of funds, especially for the General Dynamics F-16 fighter which is being built in Europe for service also with Norway, Belgium and the Netherlands. The Danish army is, however, in need of major modernization, especially in artillery and air defence weapons. The navy has plans for new submarines and surface craft but, as with a number of NATO countries, there are insufficient funds to allow all arms to be modernized at once.

No NATO forces are based in Denmark permanently although other NATO countries, including the Allied Mobile Force, do train in Denmark on a regular basis. Until 1963 Denmark did not allow any foreign troops on its soil, including NATO troops, and still does not allow nuclear weapons within the country.

HDMS **Huitfeld** *is one of 10 'Willemoes' class Fast Attack Craft designed by Lurssen and built at Frederikshavn. Her three Rolls-Royce gas turbines give a maximum speed of 38 kts, and she is armed with eight Harpoon surface-to-surface missiles and a 76-mm/62 (3-in) Compact gun.*

The Army

The Danish Army has a peacetime strength of about 18,000 officers and men of whom 7,000 are conscripts doing their nine months' national service.

Denmark is divided into Western Land Command which covers Jutland and has three brigades, Eastern Land Command which covers Zealand and has two brigades, and Bornholm region which has a battalion of infantry plus supporting armour and artillery.

The Army has two divisional headquarters and is organized into five infantry brigades, each of which has one tank battalion, two mechanized infantry battalions, one artillery battalion, one air defence battery, one engineer company and the usual support units. There are also five regimental combat teams each with two infantry battalions, one artillery battalion, one anti-tank group and reconnaissance elements. There is a single Army aviation group with eight Saab T-17 light aircraft and 12 Hughes 500M light helicopters.

Infantry weapons used include 9-mm (0.35-in) SIG P210, P220 and Browning pistols, 9-mm M49 Hovea sub-machine guns, 7.62-mm (0.3-in) Heckler and Koch G3 and 7.62-mm Garand (converted from 0.30 calibre) rifles, 12.7-mm (0.50 calibre) Browning M2 HB and 7.62-mm MG42/59 machine guns; 60-mm M2, 81-mm M/57 and 120-mm Thomson Brandt mortars; anti-tank weapons include FFV 84-mm Carl Gustav, 106-mm M40A1 recoilless rifles, and Cobra, Dragon and TOW ATGWs. Air defence is provided by the General Dynamics Redeye surface-to-air missile known in Danish service as the Hamlet.

Armoured vehicles in service include 120 Leopard 1 (delivered between 1976 and 1978) and 88 Centurion MBTs armed with 105-mm (4.13-in) guns, 48 M41 light tanks armed with 90-mm guns (3.54-in) which now fire new ammunition and are to be fitted with a new powerpack in the future, 650 M113 series armoured personnel carriers, 68 M106 mortar carriers armed with 107-mm (4.2-in) mortars, 24 M59 155-mm (6.10-in) Long Tom guns, 144 105-mm M101 towed howitzers, 96 M114 155-mm towed howitzers, 12 203-mm (8-in) M115 towed howitzers, 72 155-mm M109 series self-propelled howitzers and 36 Bofors 40-mm (1.57-in) towed anti-aircraft guns.

Danish Army reserves consist of 6,000 in the Augmentation Force which is subject to immediate recall, 35,000 in the Field Army Reserve of which 15,000 are in the Covering Force Reserve (these would bring units up to full strength and also add one mechanized infantry battalion to each of the five infantry brigades), and a further 20,000 to provide combat and logistical support. The Regional Defence Force has a strength of 24,000 with 21 infantry battalions, two tank battlions, seven artillery battalions, anti-tank squadrons and support units. There is also an Army Home Guard with a strength of 60,000 including 8,000 women.

The Navy

The Danish Navy has a total strength of 4,500 regular officers and men, 1,300 men doing their nine months' national service and 2,600 civilians. Reserves include 10,000 for the navy and 5,000 in the naval home guard.

Naval headquarters is at Århus, with additional naval bases at Copenhagen, Korsør, Frederikshavn, Thorshavn (in the Faeroes) and Grønnedal (in Greenland).

Strength of the Danish Navy includes two 'Narhvalen' class submarines built in the Royal Dockyard, Copenhagen, between 1965-70 and armed with eight 21-in (533-mm) torpedo tubes; and two 'Delfinen' class submarines built in the Royal Dockyard between 1954-64 armed with eight 21-in torpedo tubes. Two 'Peder Skram' class frigates commissioned in 1966-67 are armed with eight Harpoon surface-to-surface missiles, Sea Sparrow surface-to-air missiles, two 5-in (127-mm) guns, four Bofors

The Saab MFI-17 Supporter is one of the lightest of all current trainer and light attack aircraft, having a maximum speed of 235 km/h (146 mph). The Danish air force acquired 32 examples for side-by-side dual training. This machine is one of the eight operated by the army aviation group.

40-mm (1.57-in) L/60 anti-aircraft guns, depth charges and anti-submarine torpedoes. Three 'Niels Juel' class frigates commissioned between 1980-82 are armed with eight Harpoon surface-to-surface missiles, Sea Sparrow surface-to-air missiles, one OTO Melara 76-mm (3-in) Compact gun, four torpedo tubes for Mk 32 anti-submarine torpedoes and depth charges. These frigates can also lay mines. One modified 'Hvidbjørnen' class frigate, commissioned in 1976 and strengthened for navigation in ice, is armed with a single 76-mm gun and can carry a Westland Lynx helicopter aft. Four 'Hvidbjørnen' class frigates commissioned in 1962-63 are each armed with a single 76-mm gun and have a helicopter platform; these can also carry depth charges.

Light forces, well suited to the Baltic, include 10 'Willemoes' class fast attack craft commissioned between 1976-78 and armed with one 76-mm Oto Melara Compact gun, two or four 21-in torpedo tubes and eight Harpoon surface-to-surface missiles; six 'Søløven' class fast attack craft each have two or four 21-in torpedo tubes and a single 40-mm Bofors gun forward. Commissioned between 1965-67, all of these 'Søløven' class are in reserve (two of them will be used for spares).

There are also eight 'Daphne' class seaward defence craft commissioned between 1960-65, of which four were built with US funds; these are armed with one 40-mm Bofors gun, flare launchers and depth charges; there are also three 'Agdlek' class large patrol craft armed with two 20-mm cannon and used off Greenland; two 'Mågen' class large patrol craft armed with two 20-mm cannon; nine 'Ø' class large patrol craft armed with two 20-mm cannon; and 28 small coastal craft armed with a 20-mm cannon or a 12.7-mm machine-gun.

Mine warfare vessels include four 'Falster' class minelayers commissioned between 1963-64, each of which can lay 400 mines and is armed with four 76-mm guns in twin mounts; two 'Lindormen' class coastal minelayers commissioned in 1978, each of which can lay 60 mines and is armed with two 20-mm cannon; one 'Langeland' class minelayer armed with two 40-mm and two 20-mm guns; and six US-built 'Sund' class coastal mineweepers each armed with a single 40-mm gun.

Support craft include one torpedo/recovery vessel, the *Dannebrog* royal yacht, two tankers, four ice breakers, plus fishery protection, survey vessels and environmental patrol craft. The icebreakers are, however, run by the Ministry of Trade and Shipping although maintained by the navy, while the Ministry of the Environment controls such ships that are maintained and manned by the navy.

The naval air arm has eight Westland Lynx helicopters which are flown by naval crews but maintained by the air force.

Like Norway and Sweden, Denmark maintains coastal defence with forts armed with 150-mm (5.9-in) and 40-mm guns at Stevns and Langland, plus small coast-watching positions and radars.

The Danish Navy also has a special road-borne support unit for its coastal forces, as in time of war these would operate away from their main bases to avoid detection. This unit, called the MOBA, has two sections: operations and logistics. The former has vehicles with communications equipment, command facilities and radar, while the larger logistics element has vehicles carrying stores, fuel, provisions, torpedoes and ammunition.

Modernization plans include the procurement of four submarines, additional helicopters, new mine countermeasures vessels and updates for some of the attack craft.

The Air Force

The Danish Air Force has 7,500 officers and men of whom 1,500 are conscripts doing their national service. Reserves total 9,400 officers and men with the air force home guard having an additional 12,400 officers and other ranks of whom 1,800 are women. The Royal Danish Air Force is assigned to Allied Air Forces Northern Europe.

The Tactical Air Command has three fighter ground attack squadrons with 48 General Dynamics F-16A/B aircraft (Numbers 723, 727 and 730 squadrons); one fighter ground attack/interceptor squadron (Number 725) with 16 Saab Draken F-35XD fighters; and one fighter ground attack/reconnaissance squadron (Number 729) with 16 RF-35XD Draken aircraft. A total of 51 Drakens was purchased from Sweden and modified to meet Danish requirements. Missiles used by the aircraft include Sidewinder AAMs and Bullpup ASMs.

Air Material Command has one transport squadron (Number 721) and three communications flights with three Lockheed C-130H Hercules transports, three Grumman Gulfstream IIIs (used for VIP transport and maritime reconnaissance) and seven Saab T-17s. There is also a search and rescue squadron (Number 722) with seven Sikorsky S-61A helicopters and 15 T-17s are used for flying training.

The Danish Air Force also mans and operates an Air Defence Group with Raytheon Improved Hawk surface-to-air missiles.

The main air bases are located at Avnø, Aalborg, Skrydstrup, Karup and Vaerløse.

Commissioned in 1980, HDMS Niels Juel *is the name ship of a three-strong class of frigates armed with Harpoon SSMs and Sea Sparrow SAMs, as well as an OTO-Melara 76-mm Compact gun.*